Research and Best Practices Implementation Guidelines

October 2005

Prepared by
CELT Corporation
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SCHOOL BOARD OF MIAMI-DADE COUNTY
PUBLIC SCHOOLS

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Dr. Marta Pérez
District 8

Dr. Solomon C. Stinson
District 2
ACKNOWLEDGEMENTS

The Miami-Dade County Public Schools (M-DCPS) is indebted to numerous business leaders, community representatives, parents, students, school board members, and staff for their insights and guidance during the research, planning, and development of the comprehensive information technology assessment and detailed Information Technology Blueprint/Plan.

Particular credit is directed towards Ofelia San Pedro, Deborah Karcher and Sylvia Diaz for their leadership and dedication to this project, as well as the ongoing guidance provided by Dr. Rudy Crew, Superintendent of Schools.

I. Key Interviews

Algaze, Louis  Dade Association of School Administrators (DASA) President
Berkowitz, Martin A.  Chief Financial Officer
Bolaños, Frank J.  School Board Chair, District 5
Burdeen, Charles  Dade County Schools Administrators Association
Byrne, Ava G.  Deputy Superintendent
Carvalho, Alberto M.  Associate Superintendent
Cash, Kriner  Chief of Accountability and System-wide Performance
Cholak, Paul M.  Chief Personnel Officer
Cortese, Joseph  Dade County Schools Maintenance Employee Committee (DCSMEC) Business Agent
Crew, Rudolph  Superintendent of Schools
Darling, Gerald L.  Chief of Police and District Security
Diamond, Rose  Chief Facilities Officer
Diaz, Sylvia  Administrative Director, Division of Instructional Technology, Instructional Materials and Library Media Services
Dunbar, Antoinette  Deputy Superintendent for Curriculum and Instruction
Garcia, Joseph  Chief Communications Officer
Greer, Evelyn Langlieb  School Board Chair, District 9
Hantman, Perla Tabares  School Board Chair, District 4
Harris, Lisa  Confidential Exempt Personnel (XO) Chair
Henry, Sherman  America Federation of State, County and Municipal Employees (AFSCME) President
Ingram, Robert B.  School Board Chair, District 1
Karcher, Debbie  Executive Officer ITS
Karp, Martin  School Board Chair, District 3
Logan, Ana Rivas  School Board Chair, District 7
Pérez, Marta  School Board Chair, District 8
Richard, Mark  United Teachers of Dade (UTD)
San Pedro, Ofelia  Deputy Superintendent
Spaht, Carolyn  Chief of Staff
Stinson, Solomon C.  School Board Chair, District 2
Vann, Allen  Chief Auditor

II. Research, Planning, and Development Teams

The efforts of the project teams were invaluable. They provided research, analysis, recommendations, and feedback. Their insightful comments and field-based guidance was essential to the successful completion of a project of this magnitude. The following people served on the project teams:

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<td>Construction Officer, Office of Capital Improvement</td>
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Bolla, Jodi  Supervisor, Language Arts/Reading
Butler, Eugene  Principal, Parkway Middle School
Casal, Teresa  Teacher, Felix Varela Senior
Castañeda, Manny  Director II, Adult & Community Education
Chiodo, William  District Supervisor, Art Education
Collins, Denetra  Educational Specialist, Assessment
Diamond, Rose  Chief Facilities Officer, Office of School Facilities
Diaz, Sylvia  Host Team A, Administrative Director, Division of Instructional Technology, Instructional Materials and Library Media Services
Farley, Marcell  Teacher, Joella Good Elementary School
Fornell, Milagros  Principal, Felix Varela Senior High School
Gordillo, Will  Administrative Director, Exceptional Student Education
Hunter, Ronnie  Administrative Director, School Improvement Zone
Kalinsky, Robert  Director, Region Center III
Kilmer, Brenda  Media Specialist, Felix Varela Senior High School
Leichner, Artie  First Vice President, United Teachers of Dade
Levitt, Jerome  Executive Director, Office of Program Evaluation
Lopez, Lucy  Supervisor, Grants Administration
Luaces, Jorge  Design Officer, Office of School Facilities
Mallory, Felicia  Teacher, Joella Good Elementary School
Manning, Lora  Principal, Phyllis Miller Elementary School
Martin, Rose  District Director, Applied Technology
Master, Christine  Administrative Director, Professional Development
Motin, Louise  Educational Specialist, Instructional Technology
Team B and Staffing

Chapter V. Human Resources, Organizational Development, and Staffing

Chapter VI. Staff Development

Chapter XII. Community Access and Participation

Abrahante, Magaly       M-DCPS Title 1
Adler, Irwin             Principal, Herbert A. Ammons Middle School
Archer, Claude           Executive Director Instructional Staffing/Certification, Instructional Staffing
Arcia, Dr. Emily         Coordinator, Diversity Compliance
Brown, Dr. Linda         M-DCPS Hospitality Services
Castañedo, T.            Bureau of Cultural Communications
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<td>Cox, Kim</td>
<td>Principal, Miami Carol City Senior High School</td>
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<td>Cruz-Sanchez, Janice</td>
<td>Region IV Director</td>
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<td>De la Cerda, Maritza</td>
<td>Director, Personnel Operations and Records</td>
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<td>De Ogburn, Christopher</td>
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<td>Erbs, Carol</td>
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<td>Felton, Ronald K.</td>
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<td>Fernandez, Jose</td>
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<td>Ferriera-Alves, Dr. Elizabeth</td>
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<td>Soell, Cindy</td>
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<td>Tosado, Dr. Daniel</td>
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<td>Whyte, Dr. Winston</td>
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<td>Wilson, Dan</td>
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<td>Wolf, Jane</td>
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<td>Avila, Roly</td>
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<tr>
<td>Bernard, Ed</td>
<td>Client Liaison, ITS</td>
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<tr>
<td>Bonce, Gilberto</td>
<td>Principal, West Miami Middle School</td>
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<td>Bueno, Jose</td>
<td>Principal, Jose Marti Middle School</td>
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<td>Castañeda, Manny</td>
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<td>Castro, Isa</td>
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<td>Clark, Arnold</td>
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<tr>
<td>DeArmus, Maria P.</td>
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<tr>
<td>Di Benedetto, John</td>
<td>District Director, Safety/Environmental Management</td>
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<td>Diliello, Nick</td>
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<td>Diorio, Victor</td>
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<td>Dominguez, Consuela</td>
<td>Principal, Maritime &amp; Science Technology</td>
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<td>Fernandez, Carlos</td>
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<td>Galbraith, Doug</td>
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<tr>
<td>Gomez, Joe</td>
<td>Assistant Superintendent, Procurement Management</td>
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<td>Hurns, Dawn</td>
<td>Principal, Bob Graham Education Center</td>
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<tr>
<td>Izquierdo, Maria</td>
<td>Principal, Henry Flagler Elementary School</td>
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<tr>
<td>Jackson, Sharon</td>
<td>Principal, Brentwood Elementary School</td>
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<tr>
<td>Jones, Linda</td>
<td>Client Liaison, ITS</td>
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<tr>
<td>Karcher, Debbie</td>
<td>Executive Officer</td>
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<tr>
<td>Klein, Jerry</td>
<td>Administrative Director, Transportation</td>
</tr>
</tbody>
</table>
Montilla, Deborah  Administrative Director, Student Services
Moran, Chris  Maintenance Officer, Facilities Operations/Maintenance
O’Donnell, Jim  Information Security Analyst, ITS
Osborn, Bernie  Principal, Greynolds Park Elementary School
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Pou, Connie  Controller
Rinehart, Craig  ITS Director of Infrastructure
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Rodriguez, Douglas  Principal, Miami Springs Sr. High School
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Sarmiento, Roberto  Secondary Counselor, Barbara Goleman Sr.
Singler, Ray  Coordinator III, Facilities Projects
Torrens, Jamie  Inspections Officer, District Inspections, Operations & Emergency Management
Trupia, Linda  Director, Instructional Technology
Urrutia, Rafael  Accountability Officer, Title I
Vann, Allen  Chief Auditor, Management & Compliance Audits
Webb, Judy  Chief Budget Officer, Financial Operations
Wolf, Jane  Teacher/Trainer, Region Center IV
Zapata, Diane  District Supervisor, ITS

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Chapter VIII. Policies, Procedures, and Security
Chapter XI. District-, School-, and Program-level Planning
Chapter XIII. Monitoring and Evaluation

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Chebbi, Tarek  Director, Office of Strategic Planning
Clark, Arnold  Office of Information Technology
Dittmar, Kris  Principal, Kendale Elementary School
Dominguez, Consuelo  Principal, MAST
Evans, Pat  Supervisor, Library Media & Instructional Materials
King, Verdell  Region Center Director, Region III
Koski, Joanne  District Director, Procurement Management Services
Levitt, Jerry  Supervisor, Educational Evaluation
Lopez, Richard  Executive Director, Office of Strategic Planning
Master, Christine  Administrative Director, Professional Development
Mijuskovic, Sylvia  Executive Director, School Quality Improvement
Morris, Don  DPAA Sr. Management Analyst, Research Services
Montes de Oca, Jose  Assistant Chief, Management and Compliance Audit
Pimienta, Alberto  Supervisor, Library Media & Instructional Materials
Rivas, Dr. Eduardo R.  Host Team D, Administrative Director, Office of Performance Improvement
Robinson, Harry  Teacher, Frances S. Tucker Elementary School
Rohm, Terry  ITS
Tyndall, Robert  Supervisor, Procurement Management Services
### Miami-Dade County Public Schools

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<td>Vann, Allan</td>
<td>Chief Auditor, Management and Compliance Audit</td>
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<td>Wagoner, Heather</td>
<td>Supervisor, Assessment and Data Analysis</td>
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<td>Whyte, Dr. Winton</td>
<td>Principal, McMillan Middle School</td>
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**CELT Corporation**

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<tr>
<td>Bajgot, Jeff</td>
<td>Vice President of Technology Infrastructure Services</td>
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<tr>
<td>Boegli, Bob</td>
<td>Executive Partner</td>
</tr>
<tr>
<td>Choate, Dr. Angela</td>
<td>Senior Research Associate</td>
</tr>
<tr>
<td>DeLetis, Connie</td>
<td>Project Manager</td>
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<tr>
<td>Dunlap, Cyndi</td>
<td>Senior Research Associate</td>
</tr>
<tr>
<td>Getz, Sarah</td>
<td>Administrative Support</td>
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<tr>
<td>Goodell, Jim</td>
<td>President Product/Services Development</td>
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<tr>
<td>James, Robert</td>
<td>Project Manager</td>
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<tr>
<td>Kaplan, Marcia</td>
<td>VP for Learning Management Systems</td>
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<tr>
<td>Keating, Laurie</td>
<td>VP for Research of Planning</td>
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<tr>
<td>Kelley, Stephen</td>
<td>Chief Technology Officer</td>
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<tr>
<td>Martinez, Aida</td>
<td>Administrative Support</td>
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<tr>
<td>Oates, Dr. Rita</td>
<td>Senior Research Associate</td>
</tr>
<tr>
<td>Phillipo, Dr. John</td>
<td>Chief Executive Officer</td>
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<tr>
<td>Schaffer, Sherrie</td>
<td>Administrative Support</td>
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<tr>
<td>Speight, Marilyn</td>
<td>Administrative Support</td>
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III. Site Visits

Each of the six regions sponsored three school site visits, a regional community group meeting for parents, business industry, and community leaders, as well as a student focus group representing a cross-section of elementary, middle, and high school students. The following schools hosted on-site visitations:

Region 1
- Flamingo Elementary School
- Lawton Chiles Middle School
- Hileah Senior High School

Region 2
- Hubert O. Sibley Elementary School
- John F. Kennedy Middle School
- North Miami Senior High School

Region 3
- Arcola Lake Elementary School
- Doral Middle School
- William Turner Technical School

Region 4
- Miami Shores Elementary School
- George Washington Carver Middle School
- Miami Jackson Senior High School

Region 5
- Cypress Elementary School
- Paul Bell Middle School
- Southwest Miami Senior High School

Region 6
- Jack D Gordon Elementary School
- Richmond Heights Middle School
- Felix Varela Senior High School
### III. Focus Groups

The following focus groups were conducted in order to assess the information technology needs from multiple perspectives. The focus groups were attended by M-DCPS staff from all levels including classroom teachers, support personnel, and school/district administrators:

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Once again, on behalf of the students, staff, parents, and community leaders within Miami-Dade County, appreciation and gratitude is expressed to Dr. Rudy Crew and Ms. Ofelia San Pedro for their relentless leadership and vision in order to ensure the effective integration of technology into the teaching, learning, and management processes with a clear focus on increasing student achievement.
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1.0 INTRODUCTION

The Research and Best Practices Implementation Guide is a compilation of research prepared by representatives from the Miami-Dade County Public Schools (M-DCPS) and CELT Corporation to correspond to the major recommendations in the Information Technology Blueprint. This research comes from a variety of sources, including articles, journals, and vendors, as well as local, state, and federal documents, and is predicated on the detailed key findings documented in the Initial Findings and Preliminary Recommendations report. The entire collection provides a comprehensive, long-term Comprehensive Information Technology Blueprint and Plan for Miami-Dade.

This Comprehensive Information Technology Blueprint /Plan provide a roadmap for technology implementation in M-DCPS over the next three years and also designed to:

- present the major recommendations developed from the needs analysis phase of the project for the design and implementation of an information technology infrastructure that incorporates networks and current technology tools into engaging learning environments and inviting school building facilities
- identify technology staffing needs, standards for procurement and maintenance, and the policies and procedures required to support an efficient and effective technology environment
- define approaches, initiatives, and accompanying action plans for the implementation of technology in the BCPS' highest priority areas, all with clearly defined lines of responsibility and educational accountability
- clarify needed staff technology proficiencies and training, coordinate multi-level planning processes, and define business systems re-engineering strategies that facilitate decision-making

The Research and Best Practices Implementation Guide is organized into thirteen major chapters which correspond to the thirteen major chapters in the Information Technology Blueprint, and can be referenced accordingly. The fifteen chapters are:

**Chapter 2: Curriculum and Assessment**

Chapter II: Curriculum and Assessment of the Information Technology Blueprint focuses on the role of technology resources to enhance the delivery of curriculum content and support the assessment of student achievement.

**Chapter 3: Teaching and Learning Technologies**

Chapter III: Teaching and Learning Technologies of the Information Technology Blueprint focuses on the types of technology-based teaching and learning resources that will be made available to M-DCPS teachers, students, and community members.
Chapter IV: Learning Environments and School Facilities

Chapter IV: Learning Environments and School Facilities of the Information Technology Blueprint focuses specifically on the types of learning environments that can be configured, reconfigured, and moved to achieve ubiquitous access to learning resources for all students. Additionally, the standards for facilities technology infrastructure are addressed to ensure that all schools have the ability and flexibility to create a wide variety of exciting and engaging learning environments.

Chapter V: Human Resources, Organizational Development and Staffing

Chapter V: Human Resources, Organizational Development, and Staffing focuses on providing M-DCPS with a staffing and organization roadmap to meet the demands of implement this Information Technology Blueprint.

Chapter VI: Staff Development

Chapter VI: Staff Development of the Information Technology Blueprint is designed to focus on the staff development and training needed to support the use of technology within the Miami-Dade County Public Schools. Staff development promotes continuous learning and improvement among teachers and other school staff. Ideally, professional development includes education, training, and support for using technologies. The use of technological tools in the recruitment, selection, and retention of staff is described.

Chapter VII: Standards, Procurement, and Maintenance

Chapter VII: Standards, Procurement, and Maintenance of the Information Technology Blueprint focuses on improving the districts processes in this area and recommending how technology could be used to assist in these improvements.

Chapter VIII: Policies, Procedures, and Security

Chapter VIII: Policies, Procedures, and Security of the Information Technology Blueprint focuses on those parts of the organization that communicate strategic direction and formalize organizational practice.

Chapter IX: Administrative Computing and Decision Support Systems

Chapter IX: Computing and Decision Support Systems of the Information Technology Blueprint focuses on enhancing the functional capabilities and efficiencies of administrative and decision support systems to support district operations. By developing new strategies to enhance user operational capabilities with associated improvement in service delivery it will be possible to better serve present needs and provide the foundation for advanced administrative support and decision support capabilities in the future.
Chapter X: Communications and Network Infrastructure

Chapter X: Communications and Network Infrastructure of the *Information Technology Blueprint* focuses on continued enhancement and expansion of advanced infrastructure systems for communication, computing, and networking throughout the district.

Chapter XI: District-, School-, and Program-level Planning

Chapter XI: District-, School-, and Program-level Planning of the *Information Technology Blueprint* focuses on a coordinated approach to district, school, and program-level planning. This chapter addresses the ways in which technology resources can support and enhance the planning efforts in M-DCPS. It further describes processes and procedures to track the effects of planning and to monitor success.

Chapter XII: Community Access and Participation

Chapter XII: Community Access and Participation focuses on needs of the M-DCPS community to participate in life-long learning experiences from home, school, and other locations; to better connect school and the world of work; and to access the information they need to make informed educational choices and decisions.

Chapter XIII: Monitoring and Evaluation

Chapter XIII: Monitoring and Evaluation of the *Information Technology Blueprint* focuses on the processes, structures, and tools for monitoring the implementation of the plan and evaluating its impact in terms of quality and effectiveness.

Chapter XIV: Budget, Funding Sources, and Total Cost of Ownership (TCO)

Chapter XIV: Budget, Funding Sources, and Total Cost of Ownership (TCO) of the *Information Technology Blueprint* focuses on planning for and funding technology expenditures.
2.0 CURRICULUM AND ASSESSMENT

The federal No Child Left Behind (NCLB) legislation requires that schools and districts across the nation invest their federal funds for student achievement on strategies that are scientifically proven best practices. NCLB is designed to change the culture of America’s schools by closing the achievement gap, offering more flexibility, and giving parents more options. States must produce annual state and school district report cards that inform parents and communities about state and school progress. Schools that do not make progress must provide supplemental services, such as free tutoring or after-school assistance; take corrective actions; and, if still not making adequate yearly progress after five years, make dramatic changes to the way the school is run.

Included in the Technology Blueprint are a number of Major Recommendations. The purpose of this section is to provide a summary of the research and best practices information available to support the recommendations. The major recommendations related to Curriculum and Assessment are:

- C&A-1: Align Technology Standards Across the Curriculum
- C&A-2: Integrate Technology Across the Curriculum
- C&A-3: Adopt District-Wide Online Assessment Tools
- C&A-4: Provide Teachers with Electronic Tools for Data Entry
- C&A-5: Select District-Wide Comprehensive Instructional/Learning Management System

In support of these recommendations, the following information presents current research and best practices for the topics covered in Chapter II—Curriculum and Assessment. To facilitate navigation of the information in this section, the following is a table of contents for this section:

- Student Technology Standards
  - Information and Technology Literacy
  - Model Technology Curriculum

- Curriculum and Technology Integration
  - Principles of Learning
  - Integration Strategies
  - Project-based, Inquiry-based Learning (PBL)
  - Linking Education Reforms and Technology

- Assessment and Evaluation
  - Assessment Design and Development Concepts
  - Current Assessment Strategies and Initiatives
  - Using Technology for Assessment, Design, Delivery, and Analysis
  - Program Evaluation Implementation Approaches and Technologies
• Instructional/Learning Management
  – Curriculum Improvement Planning
  – Instructional Management
  – Learning Management
  – Assessment/Evaluation Management
  – Achievement Analysis and Reporting

In addition to nationally researched approaches, the current work of the M-DCPS and the state of Florida are reflected in this body of knowledge.

2.1 Student Technology Standards

The research and best practice information in the following section supports recommendation C&A-1: Align Technology Standards Across the Curriculum

M-DCPS is one of many school districts around the country that have recognized the challenge of America’s schools to prepare and empower its students to function effectively in a future destined increasingly for change, information growth, and evolving technologies. The district’s Technology Plan calls for the continued and expanded use of technology and telecommunications in the classroom as a means of addressing national, state, and local standards and an indispensable component in preparing its students for the future. The district has selected and embraced National Educational Technology Standards for Students (NETS•S) and aligned with the Competency Based Curriculum (CBC). NETS•S is part of a set of standards that are being developed or refined by the International Society for Technology in Education (ISTE) and a consortium of partners for the purpose of guiding educational leaders in recognizing and addressing the essential conditions for effective use of technology to support Pre K-12 education. The standards are research-based curriculum/technology integration approaches that align student technology standards with content standards and process skills. Standards for administrators (NETS•A), teachers (NETS•T), Educational Technology Support, and Student Assessment and Evaluation of Technology Use are also essential components of the NETS Project. Additional information on the NETS Project is available at the NETS Web site: http://www.cnets.iste.org.

2.1.1 Information and Technology Literacy

The federal No Child Left Behind (NCLB) legislation is having a strong impact on approaches to teaching and decisions regarding resources. State and district officials have prescribed learning standards for major subject areas and have aligned high-stakes testing to these standards. The integration of technology usage is pervasive throughout these curriculum frameworks and standards. The federal government has set Adequate Yearly Progress (AYP) milestones for all students and all
schools. Research-based, best-practices technology solutions have been identified to attain content goals while providing students with the technology skills required for an information-based world of work.

New 21st century “common core” skills for all students require that the district reconsider the concept that learning should be separated into discrete content areas (math, social studies, language arts, etc.). Instead, it will continue to incorporate cross-cutting competencies within each discipline. See Figure 2-1 below.

![Figure 2-1: New Common Core Skills](image)

In distinct ways, technology can assist learners at various developmental stages. In order to take advantage of developmentally appropriate, technology-enriched lessons, M-DCPS plans to develop scope and sequence of technology standards and embed them into the curriculum for elementary and secondary students as well as the staff development program and supervision/evaluation process. See Figure 2-2 below.

![Figure 2-2: 21st Century Learning](image)
Currently NETS•S standards and Information Literacy Standards have been adopted and aligned with the Competency-based Curriculum (CBC) for the district. However, no requirement is in place for teachers to implement the standards, nor is there school-level curriculum/technology integration support. Strategies for integration should supersede efforts to teach technology standards in isolation.

In response to the increasing emphasis on the important role that schools play in growing a person’s understanding and use of technology, several organizations have researched the issues and developed programs and standards. What follows are brief summaries of these valuable activities. Each summary include a link to the sponsoring organization’s website for more detailed information.

**International Society for Technology in Education (ISTE) and the National Educational Technology Standards for Students (NETS•S)**

The National Educational Technology Standards for Students (NETS•S) was introduced in 1998 by the International Society for Technology in Education (ISTE) and have been embraced by M-DCPS leadership. The state of Florida, along with thirty-three other states, has embraced these standards, and another four have adapted or aligned themselves with the standards. These standards address six foundation areas:

- Basic Operations and Concepts
- Social, Ethical, and Human Issues
- Technology Productivity Tools
- Technology Communication Tools
- Technology Research Tools
- Technology Problem-solving and Decision-making Tools

Performance indicators are provided according to grade ranges, grades Pre-K-2, grades 3-5, grades 6-8, and grades 9-12. The full listing of NETS•S standards can be found at the NETS Web site: [http://www.cnets.iste.org](http://www.cnets.iste.org).

**International Technology Education Association (ITEA) Technology for All Americans Project (TFAAP)**

In 1994, the International Technology Education Association (ITEA) launched the Technology for All Americans Project (TFAAP) to advance student attainment of technological literacy (the ability to use, manage, assess, and understand technology). TFAAP is based upon the premise that technological literacy is far more than the ability to use technological tools. Technologically literate citizens employ systems-oriented thinking...
as they interact with the technological world; fully aware of the impact such interaction has on individuals, our society, and the environment.

In 2000, ITEA published their twenty Standards for Technological Literacy (STL) grouped into five categories:

**The Nature of Technology**
- Standard 1: Students will develop an understanding of the characteristics and scope of technology.
- Standard 2: Students will develop an understanding of the core concepts of technology.
- Standard 3: Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

**Technology and Society**
- Standard 4: Students will develop an understanding of the cultural, social, economic, and political effects of technology.
- Standard 5: Students will develop an understanding of the effects of technology on the environment.
- Standard 6: Students will develop an understanding of the role of society in the development and use of technology.
- Standard 7: Students will develop an understanding of the influence of technology on history.

**Design**
- Standard 8: Students will develop an understanding of the attributes of design.
- Standard 9: Students will develop an understanding of engineering design.
- Standard 10: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

**Abilities for a Technological World**
- Standard 11: Students will develop abilities to apply the design process.
- Standard 12: Students will develop abilities to use and maintain technological products and systems.
- Standard 13: Students will develop abilities to assess the impact of products and systems.
The Designed World

- Standard 14: Students will develop an understanding of and be able to select and use medical technologies.
- Standard 15: Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.
- Standard 16: Students will develop an understanding of and be able to select and use energy and power technologies.
- Standard 17: Students will develop an understanding of and be able to select and use information and communication technologies.
- Standard 18: Students will develop an understanding of and be able to select and use transportation technologies.
- Standard 19: Students will develop an understanding of and be able to select and use manufacturing technologies.
- Standard 20: Students will develop an understanding of and be able to select and use construction technologies.

For more information on the ITEA and the Technology for All Americans Project (TFAAP), visit the Web site at http://www.iteaconnect.org/.

American Library Association (ALA) and Association for Educational Communications and Technology (AECT) ~ Information Literacy Standards for Student Learning

The Information Literacy Standards for Student Learning was developed in collaboration with the American Library Association (ALA) and the Association for Educational Communications and Technology (AECT) in 1998. These standards include nine proficiencies that are grouped into three categories:

Category I: Information Literacy

The student who is information literate:
- Standard 1: Accesses information efficiently and effectively.
- Standard 2: Evaluates information critically and competently.
- Standard 3: Uses information effectively and creatively.

Category II: Independent Learning

The student who is an independent learner is information literate and:
- Standard 4: Pursues information related to personal interests.
• Standard 5: Appreciates and enjoys literature and other creative expressions of information.
• Standard 6: Strives for excellence in information seeking and knowledge generation.

Category III: Social Responsibility

The student who contributes positively to the learning community and to society is information literate and:

• Standard 7: Recognizes the importance of information to a democratic society.
• Standard 8: Practices ethical behavior in regard to information and information technology.
• Standard 9: Participates effectively in groups to pursue and generate information.

Additional information on the Information Literacy Standards for Student Learning can be found at http://www.ala.org/aasl/ip_nine.html.

Leadership within M-DCPS continues to review, compare, and analyze the various information and technology literacy standards that have been developed at a national level.

2.1.2 Model Technology Curriculum

What Works Clearinghouse

NCLB requires that federal funds for instructional technology purchases must be used for learning initiatives that are scientifically researched best practices. To assist school districts in meeting this goal, the federal Department of Education is developing a Web site of scientifically, researched best practices strategies and solutions for K-12 school improvement and academic achievement. The What Works Clearinghouse (WWC) was established in 2002 by the U.S. Department of Education’s Institute of Education Sciences and is located at http://www.w-w-c.org/.

NETS Connecting Curriculum and Technology

In Fall 1999, ISTE published Connecting Curriculum and Technology, a comprehensive collection of curriculum-integration strategies that are aligned to the NETS•S and national curriculum standards. Connecting Curriculum and Technology presents learning activities highlighting the effective use of technology in teaching and learning at four instructional levels: PreK-2, 3-5, 6-8, and 9-12, and in five content areas: English Language Arts, Foreign Languages, Mathematics, Science, and Social
Studies. Sample multidisciplinary resource units are also included, two samples each for the four instructional levels. The full text of *Connecting Curriculum and Technology* can be downloaded from the NETS Web site: [http://www.cnets.iste.org](http://www.cnets.iste.org).

**Model Curriculum for K-12 Computer Science (ACM)**

The proposed *Model Curriculum for K-12 Computer Science* presents four distinct levels:

- **Level I** address grades one through eight and incorporates NETS with an introduction to algorithmic thinking.
- **Level II** includes students in grades nine and/or ten, with emphasis on a coherent and broad understanding of the principles, methodologies, and applications of computer science in our modern world.
- **Level III** targets students in grades ten and/or eleven, and places particular emphasis on the scientific and engineering aspects of computer science.
- **Level IV** provides students in grades eleven and/or twelve with advanced study (may include the AP computer science course) in programming and data structures. Level IV courses may also lead to a professional certification.

The attainment of this model will take time; teacher preparation, the development of state-level content standards in this area, and curriculum development.

### 2.2 Curriculum and Technology Integration

*The research and best practice information in the following section supports recommendation C&A-2: Integrate Technology Across the Curriculum*

The district’s focus for the *Instructional Technology Plan* produced by the Instructional Technology Department (2005) was the “integration of technology into the instructional program to improve learning outcomes and prepare students for the future.” The department has made considerable progress in implementing its mission of “ensuring technology literacy for every student, teacher, and administrator.” As of fall 2004, Instructional Technology and Curriculum has begun to discuss how technology can help address national, state, and local standards within the various curricular areas. Research shows that if technology solutions do not address learning goals and priorities, teachers will be reluctant to embrace their use. It is important then for districts that want improved learning to understand the role of technology and make decisions that clearly link hardware, software, and infrastructure with best practices teaching and learning strategies to meet established learning goals.
The District’s instructional leadership seeks to embrace a variety of approaches to address curriculum and technology integration efforts. The subtopics under this topic include:

- Principles of Learning
- Integration Strategies
- Project-based, Inquiry-based Learning
- Linking Education Reforms and Technology

### 2.2.1 Principles of Learning

Principles of learning are aided through technology integration. Student learning and achievement is enhanced through good practices that are driven by technology.

- Good instructional practice encourages contacts between students and teachers. Effective student-teacher contact in and out of the classroom helps to improve student motivation and encourage participation. E-mail, computer conferencing, and the Internet are excellent aids for increasing student-teacher interaction.

- Good instructional practice develops reciprocity and cooperation among students. Working together often increases participation and learning. Research shows that the most effective way to learn something is to teach it. Students teaching each other all gain from the experience. Televised class sessions, study groups, and group problem solving can be done with electronic media.

- Good instructional practice uses active learning techniques. Students learn more when they discuss, relate, and readily apply what they are learning. Simulation software and tools can richly enhance active learning.

- Good instructional practice gives prompt feedback. Immediate and direct critique of the student’s performance helps the student to reflect on and assess what has and has not been learned. Video critiques and the comment option available in word processors are excellent for providing immediate responses.

- Good instructional practice emphasizes time on task. Utilizing one’s time wisely equates to effective learning for students and teaching for faculty. Technologies can increase efficiencies by reducing commuting time and information search time for resources.

- Good instructional practice communicates high expectations. High expectations encourages the good, the bad, and the not-so-good student to perform better—the self-fulfilling prophesy. Technologies that increase peer-evaluations and shared learning teams increase student participation and expectations.
• Good instructional practice respects diverse talents and ways of thinking. Many learning opportunities are enhanced through students with different talents and learning styles. New technologies can tailor learning materials to different learning styles and enhance collaborations.

2.2.2 Integration Strategies

Curriculum and technology integration can best be described as the alignment of content standards with technology and problem solving so that students and teachers learn about technology by teaching and learning with technology. Core technology standards provide the direction for infusing technology tools and resources into appropriate curriculum areas. An Integrated Unit Plan (IUP) model can assist teachers with the curriculum/technology integration process by ensuring equity and access to fundamental technology competence. This model is depicted in Figure 2-3 below.

![Figure 2-3: Curriculum/Technology Integration Approach](image)

An IUP simultaneously targets content standards, student technology/communication standards, and other appropriate cross-cutting competencies/process skills within specific subject areas. Individual integrated unit plans can serve as maps for the development of curriculum packages that guide daily instructions. Development of IUPs can be a major staff development activity for improving teacher capacity in curriculum/technology integration. Teachers not directly engaged in
developing IUPs can nonetheless benefit greatly from reviewing and adopting IUPs that have been approved. A resource bank of approved IUPs can become an invaluable resource for integration models. The models can be searched by grade level, discipline, learning standard, technology competency, or key words.

Over time, the successful alignment of curriculum and technology through the use of IUPs will bring about observable changes in teaching and learning environments.

The more students and teachers learn about the potential of specific applications and technology resources, the more they will be able to teach and learn with these powerful tools.

**Curriculum Integration Techniques**

The following is a sample list of Web sites with tools for curriculum integration:

- **Equity Index**—Locates resources and tools to help meet the needs of a diverse classroom. Web site: [http://equity.4teachers.org](http://equity.4teachers.org)
- **RubiStar**—Creates customized rubrics in English and Spanish. Web site: [http://rubistar.4teachers.org](http://rubistar.4teachers.org)
- **TrackStar**—Views thousands of on-line lessons or quickly create one’s own. Web site: [http://trackstar.4teachers.org](http://trackstar.4teachers.org)
- **QuizStar**—Constructs on-line quizzes that can include multimedia. Web site: [http://quizstar.4teachers.org](http://quizstar.4teachers.org)
- **Assign-A-Day**—Posts one’s own on-line class calendar with hyperlinks and projects. Web site: [http://assignaday.4teachers.org](http://assignaday.4teachers.org)
- **Casa Notes**—Assembles take-home notes in English and Spanish. Web site: [http://casanotes.4teachers.org](http://casanotes.4teachers.org)
- **PBL Checklist**—Makes custom checklists for multiple projects. Web site: [http://pblchecklist.4teachers.org](http://pblchecklist.4teachers.org)
- **Web Worksheet Wizard**—Makes and posts a simple Web page within minutes. Web site: [http://wizard.hprtec.org](http://wizard.hprtec.org)
- **NoteStar**—Assists students with collecting group notes and citations for papers. Web site: [http://notestar.4teachers.org](http://notestar.4teachers.org)
- **Think Tank**—Provides students with a tool to create and post Web pages for projects. Web site: [http://thinktank.4teachers.org](http://thinktank.4teachers.org)
Daily Curriculum Integration Activities

Examples of curriculum/technology integration activities are as follows:

- **Project Poster**—Provides students with a tool to create and post Web pages for projects. Web site: [http://poster.hpr.tec.org](http://poster.hpr.tec.org)

- **Access an on-line weather forecast**—UM Weather, The Weather Channel, or USA Today Weather, to find out what the rest of the day might bring or what the weather in other parts of the country might be.

- **Include URLs in one’s monthly calendar**—The October calendar, for example, might offer links to sites about Christopher Columbus, daylight savings time, and Halloween. (A child-friendly search engine such as Yahooligans will help locate appropriate sites.) Or students can find the sites themselves as they complete a Months of the Year Project.

- **Access on-line weather forecasts in French, German, or Spanish**—The Weather Channel provides weather information for Brazil, Germany, France, and Latin America in the native language of each country.

- **Challenge students with on-line mathematics problems**—The Math Forum’s Math Problem of the Week offers word problems in five categories--math fundamentals, pre-algebra, algebra, geometry, and pre-calculus. The AIMS Puzzle Corner Math Challenge of the Month provides a monthly math-related puzzle and/or printable worksheets. Aunty Math’s Math Challenges for K-5 Learners offers bi-weekly word problems for younger students while high school students will enjoy the news-related math problems at Math Counts, as well as Mike’s Puzzle of the Week.

- **Provide a URL in place of a quotation**—Quote of the Day, Quotes of the Day, and Quote A Day are all excellent sources of funny, inspirational, or thought-provoking quotes.

- **Introduce a word of the day**—The Daily Buzzword at Word Central provides a word of the day and related activity appropriate for upper elementary students. Vocabulary Builder offers words and definitions for students in grades 4-6 and grades 6-9. The words and definitions at A Word a Day and Word of the Day are best for students in middle and high school. In addition, students in grades K-8 can safely extend their on-line experience by submitting phony definitions to Fake Out.

- **Enhance spelling**—Each week, Carolyn’s Corner offers a new list of "Paideia Words of the Week;" from the study booklet for the Scripps Howard National Spelling Bee. Students can compete with the nation’s best spellers.
- **Make history real**—Personalize history lessons for those students by beginning each history lesson with a quick visit to Today in History or This Day in History.

- **Utilize on-line work sheets**—Each week, Education World provides a new printable Scavenger Hunt and a Writing Bug creative writing activity. In addition, Teach-nology offers work sheets in a variety of curriculum areas. Or, students can complete a weekly WebQuest.

- **Offer on-line SAT practice**—SuperKids provides a PSAT and SAT Vocabulary Builder in the form of a word of the day.

- **Enhance history lessons**—When planning U.S. history lessons, visit the Library of Congress's American Memory Collections search engine to locate primary source material for whatever topic. It encourages students to include primary source materials in their history papers as well.

- **Provide on-line reading comprehension practice**—Each month, The Comenius Group provides a new Fluency Through Fables lesson. Designed for students of English as a second language, the activity is appropriate for English-speaking students in elementary and middle school as well.

- **Incorporates on-line news sources into discussions of current events**—CNN and MSNBC are excellent places to start looking for national and international news. Or Online Newspapers will locate a local newspaper on-line. The Internet Public Library also provides links to local news sources by country and, for the United States, by state.

- **Make the news a learning tool**—The Why Files, for example, uses news and current events as the basis for science, health, and technology lessons. What caused the tornado that devastated the Midwest or the hurricane that hit Florida? How does war affect those living in battle zones? What vote-counting technique is most accurate? The Why Files will explain it all. How Stuff Works also is an extensive site with information on a vast number of topics. Today's students, for example, might want to learn How Stinger Missiles Work, How Stem Cells Work, or How Hybrid Cars Work.

- **Spice up grammar lessons**—Sign up for Daily Grammar to receive a free grammar lesson plan every day and a quiz every week.

- **Make science a daily event**—If a teacher has trouble finding time for a more formal science lesson, he/she might discuss NASA's Astronomy Picture of the Day or Goddard Space Center's Earth Science Picture of the Day, both of which include a brief explanation of the day’s photo. He/she might also briefly discuss a scientist or a scientific event from Today in Science History or explore a Science Question of the Week.
• **Sign up for a science experiment of the week**—Teachers/students may sign up for a science Experiment of the Week. Each week, a new science experiment will be e-mailed to the instructor.

• **Make geography a daily event**—For most students, geography has something to do with maps. Students may extend their geography awareness by challenging themselves to answer the five daily questions posed at GeoBee Challenge. The questions are taken from the National Geographic Geography Bee. If a teacher is looking for a quicker lesson, he/she might find it at How Far Is It? National Geographic's Map Machine can even make maps fun.

• **Keep them guessing**—Each week, Houghton Mifflin poses new, primarily math-related Brain Teasers at three different grade levels--3-4, 5-6, and 7-8. Solving the problems at Mystery Net generally demands more logic than math.

• **Send them away with a smile**—Finally, a teacher may end a successful week with Education World's Joke of the Day.

### 2.2.3 Project-based, Inquiry-based Learning (PBL)

Real problem solving and simulating real problems are two functions of project-based, inquiry-based learning (PBL). Students work in groups and help select their own projects and create learning opportunities based upon their diverse interests and knowledge. Students have the opportunity to create and solve their own problems using multiple intelligences. This form of active learning enhances the conceptualization of the way systems function and increases the student’s rate of retention. The teacher’s role throughout this process is to guide and advise rather than to direct and manage.

Prior to the advent of educational technologies, project-based learning at the elementary level included markers, scissors, glue, and research in primarily print-based texts, reference materials, and magazines. At the middle and high school levels, project-based learning might have involved science labs (dissections and chemical reactions), the occasional research paper, and the annual science/interest fair. The infusion of 21st century technologies into our schools has changed the face and impact of project-based learning significantly. Now PBL presents the potential to engage students in investigation, analysis, and understanding of real-world problems/issues, using the tools of 21st century citizens, in authentic and exciting learning units. PBL requires many educators to teach differently from what they are accustomed to doing in the past.

PBL requires that students use technology to:

- engage in sustained reasoning
- manage complexity
• test a solution
• manage problems in faulty situations
• organize and navigate information structures and evaluate information
• collaborate
• communicate to other audiences
• PBL requires the following paradigm shifts for educators: learners of all ages, not just elementary-aged students, learn when they collaborate and build upon existing knowledge
• students learn from and need to be encouraged to engage in dialogue about their content material
• the role of the teacher becomes more project manager and less dispenser of information
• students should be supported with tools and resources to solve problems actively rather than passively receive information

Staff development in support of PBL methodology includes:
• introduction of constructivist philosophy
• demonstration of PBL strategies
• development of teacher expertise using PBL through Web quests
• access to resources to develop new instructional materials
• encouragement of cross-curricular integration
• integration of rubrics and authentic assessment strategies

Staff development for the integration of technology to support PBL might include:
• Internet publishing
• Internet-based research practices
  – Refining search criteria
  – Selecting relevant resources
  – Authenticating Internet resources
  – Intellectual property and plagiarism rules for using materials from web sites
• Web page design
• presentation software
• digital camera, camcorder, and scanner use
The integration of technology to support PBL will be successful if these critical success factors are addressed:

- **Evaluation** – This evaluation is focused on teachers’ advancement in technology skills, linked directly to PBL implementation and the ways it is implemented to support district-learning goals.
- **Support** – The support offered teachers, including professional-development opportunities, technical support, mentoring, principal leadership, and community support, is critical to the success of pilot and broad-scale implementation of PBL.
- **Funding** – A variable that cannot be ignored for any broad-scale initiative designed to engage any major change in instruction is funding. Total cost-of-ownership (TCO) funding approaches ensure that funds required for staff development, resources (hardware/software/peripherals/consumables), ongoing support, and maintenance are included in the implementation budget.

Technology tools that are available to support PBL activities include:

- digital microscopes
- digital cameras and camcorders
- graphing calculators
- hand-held computers
- digital tablets
- probes and probeware
- Internet tools (dissections, simulations, data collection projects)
- Internet resources (experts, government and scientific data collection sites, libraries, museums)
- global Webcams (cameras running around the globe around the clock)
- print and video archives

### 2.2.4 Linking Education Reforms and Technology

Curriculum and technology integration strategies should also address the process of aligning learning resources with:

- identified instructional reform efforts (cooperative learning, real-world applications, authentic assessment, national standards)
- developmental needs of the learning population (primary, elementary, middle school, high school, and adult learners)
- staff attitudes and competencies
- specific technology hardware and software solutions
Equally relevant is the consideration that the integration of instructional technologies through the creation of technology-enhanced learning environments is not the end target, but rather the means toward addressing school and district priorities in the area of educational reform. Reform efforts in curriculum and instructional content areas include:

- national standards
- technology and information literacy
- thematic units, authentic learning, and interdisciplinary instruction
- accountability and assessment
- school-to-work certifications and experiences

Reform efforts, pertaining to the manner in which students learn, include:

- constructivism
- discovery learning
- active learning
- inquiry-based learning
- multiple intelligences
- cooperative learning

Reform efforts in the assessment of improvement and growth include:

- authentic assessment
- portfolio assessment
- performance-based assessment
- outcome-based assessment

The integration of technology as a part of the solution to achieve reform includes the following:

- Designing – Whether designing curriculum, lesson plans, or presentations, technology tools can help leadership, teachers, students, and community members. These tools include graphic design tools, templates, Web-design programs, digital pictures, and graphics to enhance designs of all sorts.

- Communications – The use of e-mail in society as a communication tool is nearly ubiquitous among those with access to computers. Chat rooms, Web postings, interactive courseware (such as Blackboard), all enhance communication between individuals and among groups of learners.

- Publication – Publishing artifacts and newsletters and creating presentations and videotapes are all valuable tools in achieving the district goals for reform.
• Research—Students, teachers, and school/district leaders now have access to nearly infinite resources beyond the traditional textbook, library reference, or professional journal. Information can be garnered on nearly every topic imaginable for the researcher with savvy query and search strategies.

• Organization of Ideas – Concept mapping applications, such as Inspiration and Kidspiration, enable all learners to present ideas with links, relationships, and interdependencies between and among concepts. These visual organizers allow the user to toggle between both text and graphic representation.

• Management – Project management tools assist the school-age learner as well as the adult learner. Strategies such as PBL require students to collaborate, stay on task, and meet milestones that are critical to the success of the project. Technology tools that allow teams to track progress, benchmarks, and milestones assist both educators and students alike.

2.3 Assessment and Evaluation

For years, the assessment and evaluation process has relied primarily on teacher-made and standardized tests, and a variety of unstructured teacher observation techniques. If the district is to change the fundamental processes of teaching and learning successfully in a new era of education, then it must also advance to new ways of assessing student performance and the curricular programs it employs to impart the new skills necessary for the knowledge workers of the future. New tools for assessment can be supported by new technology tools, but what design and development concepts must be considered in the delivery system for authentic assessment?

2.3.1 Assessment Design and Development Concepts

As we consider the appropriateness of current and future assessment strategies, each should be weighed against set criteria, with performance varying in light of the applied criteria. Decisions on the application of these assessment approaches in learning situations need to be based on such factors as:

• reliability
• validity
• costs
• time requirements
• ease of use
• match to program goals
• degree of integration with learning activities
• timeliness of assessment data
• teacher learning threshold
• needs for aggregation and analysis of assessment data

The following sub-sections offer detailed definitions and discussions of each of these factors.

Reliability

The reliability of an assessment technique refers to its capacity to measure consistency in scores over time. The reliability of standardized tests has been carefully researched and can be accurately estimated using statistical procedures with repeated trials. Assessment data resulting from teacher-made tests and daily observations may be less reliable due to factors such as subjectivity or less structured conditions. Technology can improve the reliability of these types of measures. For instance, scanable answer sheets can be employed for teacher-made tests and technology systems can analyze the reliability, difficulty, and discrimination factor of individual test items. Holistic scoring techniques can improve the reliability of essay questions.

Validity

Teachers are challenged to develop valid test instruments that reflect the content to which students are exposed. Validity is a key criterion. Any assessment technique must accurately measure the desired learner outcome to be considered valid. The validity of standardized tests is often questionable since the test items included are a sampling of content from the most popular textbooks and may not reflect the desired learner outcomes of a particular class of students. Validity is an issue for teacher-made tests since it is often difficult to determine whether or not the sample of test items mirrors what has been taught without employing statistical procedures over repeated applications of the instruments. In contrast, the validity of performance events can be readily tied to particular learner outcomes. Thus, an on-line assessment tool with valid and reliable banks of test items is critical for classroom-based assessment.

Cost

Costs are a factor in all assessment techniques. The costs of administering, scoring and analyzing standardized tests have risen sharply over the years and constitute a major income source for educational publishers. There are reproduction and scoring costs associated with teacher-made tests, and there are costs associated with establishing technology solutions for scanning, storing and analyzing assessment results. However, a new class of assessment products provides low-cost scanning and scoring options.
Time Requirements

Time requirements for traditional assessment techniques are likely to be less than those for future alternative strategies, especially in terms of administration. Usually, tests can be completed in a single class period, but the time required to score and grade them can be substantial. However, technology (e.g., PDAs, on-line testing, Computer Adaptive Testing, automatic scanning, scoring, analysis, and reporting, etc.) allow teachers to make key make instructional decisions in less time than conventional paper and pencil methods.

Ease of Use

Generally speaking, standardized and teacher-made tests are easy to administer. Authentic assessment approaches, such as structured observations and data recorded with checklists, require more activity and attention from classroom teachers. Hand-held devices are currently being used by teachers for observational assessments. These devices are also being used by students for online assessments and assignments in a number of districts (refer to Chapters III and IV.)

Match to-Program Goals

This criterion relates to the concept of the validity of the assessment procedures in matching assessments directly to the desired learner outcomes (curriculum frameworks, content/academic standards, and curriculum activities). While tests tend to sample knowledge and skills from a large universe of related content, assessment techniques that focus on the effective application and demonstration of the same types of knowledge and skills may be more easily matched to program goals.

Degree of Integration with Learning Activities

Most tests, whether standardized or teacher-made, tend to assess the final outcome of the learning activities. One exception is curriculum-embedded tests that are integrated within the learning activities themselves. The advantage of curriculum-embedded tests is that they are less threatening to students and can give teachers valuable feedback concerning how individual students are proceeding toward mastery of particular content or concepts. Additionally, embedded test items can serve as a means for student self-evaluation.

Brief curriculum-embedded tests could be taken on-line at a workstation or hand-held device and analyzed automatically to produce reports for teachers. Most alternative assessment procedures, such as performance events, are integrated with the learning activities as they occur.
Timeliness of Assessment Data

Standardized and teacher-made tests may not provide timely assessment data that can be used in adjusting learning activities for groups or individuals who are not making adequate progress toward the mastery of core concepts. Conversely, many alternative assessment techniques provide instant feedback to the teacher on the progress of individual students. They become an integral part of the overall instructional delivery system. These assessments, if facilitated through technology applications available to M-DCPS, can provide more immediate information to support instructional planning and individual learning activities for students having difficulty mastering a particular core concept.

Need for Aggregation and Analysis of Assessment Data

Assessment data resulting from both traditional and alternative assessments will need to be aggregated by student, teacher, program, school, and district to support accountability efforts. Therefore, assessments of all types must be fundamentally tied to a set of desired learner results that can facilitate comparisons within and across schools and stored electronically in the data warehouse and available through SPI for analysis.

2.3.2 Current Assessment Strategies and Initiatives

The purpose of an assessment is to identify areas of difficulty for individual students, gather data for instructional planning, assign grades, or evaluate a program.

The challenge for teachers is to try different methods of grading, scoring, and reporting to determine the best ways to describe students' knowledge. Tests should include multiple-choice, short-answer, and open-ended questions. They can involve discussion or interviews, and be written, oral, or computer-oriented.

Efforts to develop useful alternatives to standardized testing have proliferated during the past several years. Conventional standardized tests have shortcomings when used as the only measure of student performance and program evaluation. They are generally inconsistent with promoting effective teaching practices in terms of what is assessed, how it is assessed, and how the results are used. Also, they are ineffective at accurately measuring student performance.

The effective classroom teacher may be using alternative assessment strategies to measure student learning through non-traditional means. Alternative assessment “applies to any and all assessments that differ from the multiple-choice, timed, one-shot approaches that characterize most standardized and many classroom assessments.” In place of a standard paper and pencil test at the end of an instructional period, students might have a conference with the teacher, give an oral report, or
submit a multi-media project in place of a final, culminating assessment. Over the past decade, one of the core principles of the education reform effort is to encourage the use of a variety of assessment strategies that are customized to meet the needs of individual students. Measuring student learning with multiple assessment methods that are linked to standards, will enhance M-DCPS’ ability to meet NCLB mandates. Early feedback from schools using the Edusoft assessment software is very favorable and the district is rolling the product out to more schools.

**Benchmark Assessments**

Benchmark assessments are designed to provide diagnostic information to teachers in order to inform instruction. Reports derived from these assessments should give specific information regarding a student’s strengths and weaknesses on a particular benchmark so that teachers can focus on the standards and skills measured by the assessments.

Ideally, an on-line assessment system with valid and reliable test item banks, aligned to the Sunshine State Standards, will be available to M-DCPS educators. The system will provide for automatic scanning and scoring as well as on-line delivery and response for immediate turnaround.

**Teacher-Made Tests**

Teacher-made and standardized tests must change in order to assess the effectiveness of a standards-based curriculum. There are two major types of test—select and constructed responses. Select tests are those from which students select answers consisting of multiple-choice, matching, and true-false questions. These types of test questions usually assess knowledge and facts. With constructed response questions, students create their own answers. Examples include fill-in-the-blank and short essays. Constructed responses required students to communicate more than mere facts and often involve higher-order thinking skills. According to Danielson¹, select questions are harder to create but take less time to correct. Constructed response questions are easier to develop, but much more difficult to correct without a scoring rubric.

**Authentic Assessment**

Authentic assessment includes performance tests, observations, open-ended questions, exhibition, interviews, and portfolios that represent the student’s work at various stages of development. Glazer notes that the term "authentic" is used because the assessment procedures replicate classroom activities.

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Child-centered teachers begin to provide guidance for children based on where they function. Thus, standards for performance do not come from outside experts, but rather from the teacher and child—the best equipped experts to determine achievement.

The aim of authentic assessment is to engage students in challenges that better represent what they are likely to face as professionals and as responsible citizens. For an assessment to be authentic, the context, purpose, audience and constraints of the test should connect in some way to real world situations and problems.

Some other assessment strategies include, but are not limited to:

- anecdotal records
- checklists to monitor a work effort or project completed by both teacher and student
- learner profile observations that are recorded according to specified qualitative criteria. For example, in group work, the student:
  - divides a task among other group members
  - agrees on a plan for structuring a task
  - takes time to ensure that all members understand the task
  - remembers to record group progress or results

The activities associated with learning need to be broadened in order to accommodate a restructured curriculum that will prepare learners more effectively for the demands of the information age. It is no longer appropriate, nor accurate, to measure learning via traditional methods of evaluating and recording student performance. Real-life learning opportunities should be measured by authentic assessment methods that are made available through technology and are more readily applicable to real-life situations.

**Teacher Observation**

Teacher observation has always been a very valuable assessment technology. Professional development should be focused on helping teachers add more structure to the observation processes. Students may be observed in either an individual or group setting. The purpose of observation may be to determine a student's competence in a given subject area or to determine appropriate behaviors and attitudes.

In addition to these forms of observational assessment, informal assessment has a role to play. Research shows that teachers should bring knowledge of various learning styles to “classroom observing” and “kid watching” to expand and improve their teaching practices, and to
increase the quality of their informal assessment of student learning. Carol Furtwengler in "How to Observe Cooperative Learning Classrooms" also points out that administrators who bring knowledge of various teaching styles to their classroom observations support teachers in expanding their repertoire of effective teaching practices.

**Anecdotal Records**

Anecdotal records are documented accounts of a child's progress, including accomplishments particular to that child's social, emotional, physical, aesthetic, or cognitive development. The teacher records the information informally while instructional activities are taking place. Anecdotal records may be particularly helpful for:

- noting students' changes and growth over time
- conferencing using information gathered
- maintaining an accessible tool for evaluation
- evaluating progress within a non-threatening learning environment
- guiding changes in instruction and curriculum
- aggregating multiple sources of data on preferences, attitudes, social behavior, etc.

A hand held device, such as a personal digital assistant, will be particularly helpful in accumulating anecdotal information.

**Checklists**

Checklists are a more formal and systematic means of structured observation. They are simple and efficient ways of collecting and organizing information about students. They can be used to communicate class goals to students and record what is already occurring in the classroom. Some suggestions for checklists:

- focus on a manageable number of students (three-to-five) each day
- use the checklist periodically to obtain a broad picture of the student and not changes in behavior and attainment of instructional goals
- have students use the checklist, themselves, to evaluate their own performance in a given content area

As indicated earlier, technology can be used to support this type of assessment. Checklist data can be scanned by optical readers or collected real-time with a light pen, bar codes, or hand-held devices.

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Rubrics

A rubric is a scoring guide commonly used to assess constructed responses and alternative assessments. According to Popham, the most important components of a rubric are the evaluative criteria or “the factors a scorer considers when determining the quality of a student's response.”

Educators embracing project-based learning models regularly incorporate assessment and evaluation rubrics to provide students with clear expectations in the areas of team work, content, creativity, and final presentations/products. For example a rubric for a writing assignment might include performance indicators for: (1) Introduction; (2) Analysis; (3) Support for Topic; (4) Transitions; (5) Conclusion; and, (6) Grammar, Spelling, Capitalization, and Punctuation. The performance indicators are frequently developed for four performance levels:

- Minimum performance indicator/does not meet the standard
- Limited performance indicator/partially meets the standard
- Sufficient performance indicator/meets the standard
- Superior performance indicator/exceeds the standard

The use of performance-based rubrics provides the learner with an understanding of the task, the specific components of the task and the way they will be evaluated, and the relative importance or priority level of task components. For example, is content more highly ranked than creativity?

Conferencing and Interviewing

Opportunities for obtaining information concerning a student's thoughts, understandings, and feelings about a given subject area can be facilitated through interviewing and conferencing with individuals. An interview should consist of a planned sequence of questions while a conference implies a sharing of ideas between the teacher and student. Although these techniques may be somewhat time-consuming, they can be very beneficial to both teacher and student. The student receives encouragement and feedback from the teacher; the teacher gains an understanding of the student's individual needs which can lead to the identification of methods for modifying classroom instruction.

Topics for conferences and interviews may include:

- relationships with other students
- approaches and strategies for completing work
- task comprehension
- communication
- flexibility in procedures
• hypothesis development
• self assessment

Regardless of the particular intent of a meeting between the teacher and an individual student, the process itself communicates that the student's own ideas are valued and provides encouragement for continued progress.

**Performance Events**

Curriculum and assessment must promote the kind of performance that people encounter in the real world of work and cooperative living. People are valued for the tasks they complete satisfactorily, their ability to communicate and work with others and their approaches to problem-solving situations. A performance event or exhibition is an assessment based on the observation of a student's actual performance on a given task or project.

Such assessments should be:

• roles or situations that all students should encounter and be expected to master
• measurements of expected learner objectives
• activities that are authentic, meaningful, engaging, and active
• complex problems that have multiple solutions

Teachers can begin with an idea that has appeal to students, consider the best ways for students to communicate their responses, determine expected outcomes, consider what learning materials are needed, define levels of performance, and develop assessment strategies.

**Portfolio Development**

A portfolio is a collection of individual student work completed over a period of time. It not only allows students to demonstrate progress toward curriculum goals, but enables them to present their best work and creative thinking. Portfolios include a variety of assignments and projects from the overall curriculum. Given advances in classroom technology, portfolios may be digitized to serve as part of the student's permanent record of schooling.

Portfolios should display student thinking, connections across academic disciplines, growth over time, views of oneself as a learner, and problem solving ability. Portfolios may contain different types of evidence of ability, including:

• problems constructed by the student
• teacher-completed checklists
• notes from an interview with a teacher
• a report on a group project
• a photo or sketch made by the student
• awards and prizes
• video, audio, and computer-generated examples of student work
• drafts and final compositions

The key is to keep the portfolio rich and diverse with achievements of which the student can be proud. Often, students keep both a working and an assessment portfolio that contains only their best work. One of the main advantages of portfolios is that they provide a more complete picture of the student's achievement of learner goals than is possible with test data alone. They also provide an opportunity for conversations between students and teachers.

**Self-assessment/Reflection**

Student self-assessment is an important component of the overall evaluation schema. It enables students to become independent learners, fosters ownership of learning, and helps students control their own progress by allowing them to reflect on their successes and mistakes on the basis of evidence they see in their own work.

Self-assessment is often done in collaboration with peers who comment on individual aspects of performance. Self-assessment conferences between teachers and students can lead to greater insights for planning future instruction. Applications such as Blackboard and First Class provide electronic environments for peer critique and self-assessment/reflection.

### 2.3.3 Using Technology for Assessment Design, Delivery, and Analysis

The research and best practice information in the following section supports recommendation C&A-3: Adopt District-Wide Online Assessment Tools

A Web-based student assessment tool, such as the one from Edusoft, can assist educators in meeting the state’s standards-based accountability requirements. Edusoft can support the creation and delivery of benchmark assessments.

A fully robust assessment system provides traditional and non-traditional (e.g., portfolio, authentic, etc.) forms of assessment to ensure the use of appropriate strategies according to the types of skills and knowledge to
be evaluated. The use of multiple assessment strategies ensures that various student-learning styles are recognized and addressed, and that different strategies are necessary, depending upon the nature of the designated student-learning objective. Assessment tools provide test creation, storage, delivery (online, printed), processing (scanned or entered on line), analysis, and reporting of results.

2.3.4 Program Evaluation Implementation Approaches and Technologies

As school districts around the country implement plans to integrate technology and the curriculum, board members, teachers, parents, and administrators are asking, “How do we know it is working?” Technology evaluations are normally the weakest components of technology plans. In order to integrate technology effectively into the curriculum, technology planners must have a reliable instrument for measuring the success of the technology plan. The following approach is presented as a model for conducting effective evaluations. The approach was developed at Western Michigan University by Brinkerhoff, Brethower, Hluchy, and Nowakoski.

Create an evaluation committee

The committee is a district-wide committee with representatives from all grade levels as well as teachers, administrators, and school board members. The purpose of the committee is to represent all stakeholders in order to effectively represent their interests and concerns.

Identify evaluation priorities and develop related evaluation questions

Evaluation priorities are usually taken from goals and objectives of the technology plan. Utilizing technology plan questions is also likely to yield results that can be used during the next strategic planning session.

Create performance indicators for each evaluation question

The performance indicators will identify sources of information (i.e., data collection methods and instruments) and criteria for making decisions.

Identify or develop data collection methods and instruments

A variety of instruments may be used for data collections such as, surveys, observations, interviews, focus groups, reviews of teacher/student work, and public meetings. The main focus is to collect data that are directly related to the evaluation questions and indicators.
Collect evaluation data

Many evaluations are attempted without collecting the proper evaluation data. Many times it can be difficult to notify and encourage stakeholders to submit evaluation data.

Create an evaluation report on the results of the evaluation, findings, lessons learned, and directions for future efforts.

Effectively summarizing and presenting the results of the evaluation is critically important to improving the delivery components of the technology plan. Electronic media such as video and PowerPoint presentations can be a tremendous asset when requesting additional funds for implementing further technology integrations.

Use the evaluation results to update your existing technology plan

Innovative efforts, instead of merely talking about the plan, should be utilized to present the data to make the program more real to those who have not been actively involved.

2.4 Instructional/Learning Management

The research and best practice information in the following section supports recommendations C&A-4: Provide Teachers with Electronic Tools for Data Entry and C&A-5: Select District-Wide Comprehensive Instructional/Learning Management System.

No Child Left Behind (NCLB) presents a bold and systemic blueprint for reform to close the achievement gap: presenting stronger accountability measures for results, more flexibility and local control, expanded options for parents, and an emphasis on best practice teaching methods. Stronger accountability measures at a time when funding for educational initiatives is disappearing have left many states at odds with the NCLB legislation. Based on an algorithm that includes the results of annual high stakes testing, NCLB requires schools to demonstrate adequate yearly progress (AYP) or face sanctions. Districts must track student progress to meet district and state goals, and also anticipate and attend to student academic needs prior to yearly testing in an economical way.

In today’s heightened accountability environment, educators need access to accurate and timely information about their students in order to take proactive measures to improve achievement. A curriculum development and instructional/learning management system, that is the cornerstone of an “ERP for Learning,” provides educators with 21st century teaching, learning, and management tools to access just-in-time information regarding:

- who we teach (learners)
- what we teach (curriculum/instruction)
• what we teach with (instructional resources)
• how well students are learning (assessment)
• by whom (facilitators/staff)

An instructional/learning management system assists educators in managing the teaching and learning process by linking curriculum/instruction, assessment strategies, instructional resources, student data, and staff resources as illustrated below:

As depicted in Figure 2-5 below, these systems consist of an integrated set of web-based applications that support the core processes of curriculum, instruction, assessment, achievement analysis and reporting, and staff development (embedded within each major area) by taking existing data and presenting it in a correlated fashion.
M-DCPS is currently implementing some of the tools to support the core processes of teaching and learning (e.g., Riverdeep’s Learning Village, Academic Improvement Plan (AIP), and Pinnacle’s gradebook. Microsoft’s Class Server and IBM’s Teacher Workbench are also being piloted in several schools). An overview of the types of tools in a curriculum development/instructional management system is found below.

2.4.1 Curriculum Improvement Planning

Curriculum Design and Development

A curriculum development and instructional/learning management system provides tools to create and manage a curriculum scope and sequence that includes content objectives, process skills, and technology proficiencies. A scope and sequence approach requires a software application that can track and align the various levels of proficiencies, instructional methodologies, and prerequisite skills for each content objective, process skill, and technology proficiency. This approach will create a map that can be used to unfold and reinforce instruction.

Each discipline can have its own hierarchical structure; however, similar structures are encouraged. Objectives can be classified according to Bloom’s Taxonomy or other taxonomies such as Krathwohl’s Affective Taxonomy. This same tool will define standards or proficiencies for staff including standards for highly qualified teachers and paraprofessionals that comply with NCLB.
Curriculum Mapping

Reports can be generated to determine if the district curriculum is aligned with state and national standards and depict any gaps in standards coverage. By mapping the “taught” curriculum against the articulated curriculum, a curriculum development, and instructional/learning management system analyzes gaps and redundancies in teachers’ lessons and units. It also monitors how frequently standards and objectives are used in units and lessons. In addition, assessments will be reviewed to determine if appropriate assessment genres match the developmental stage and age of the learners.

Using the data in this system, coupled with student achievement data from the student information system and the data warehouse, educators will use the system to perform certain curriculum audit functions by creating reports that assist with analyzing the effectiveness of the implemented curriculum.

2.4.2 Instructional Management

Designing Instruction

A curriculum development and instructional/learning management system provides the tools to enable educators to develop units, learning objects, lessons, and assessments that promote standards-based instruction. The system enables teachers to align lesson plans, units, and courses to instructional resources, assessment strategies, and to the district’s CBC and Sunshine State Standards. The system supports project-based learning as well as thematic and integrated/interdisciplinary instruction.

Instructional Resources

The district has acquired many quality resources that are aligned with standards. Links to these resources can be found in the curriculum development and instructional/learning management system. Resources that are designated as interventions can be linked into a student’s Academic Improvement Plan (AIP).

Planning and Scheduling Instruction

An online planbook provides teachers with a mechanism for recording and scheduling (through the calendar facility) quarterly (or by semester), monthly, weekly, and daily activities, assignments, and events. The planbook includes a project timeline to enable teachers to plot units, lessons, daily activities, assignments, and assessments over time. (This timeline can be viewed in a number of ways including graphically.)
The planbook contains links to appropriate units, lesson plans, activities, assessments, and resources that align with targeted objectives. Teachers can use the planbook to assign work to the whole class, groups of students or individual students. Once the assignment is created, the system automatically sends it to the student’s online assignment book. In addition, the teacher can determine whether or not the assignment should automatically populate the Pinnacle gradebook.

**Delivering Instruction**

A curriculum development and instructional/learning management system provides the platform for an enterprise’s on-line learning environment by facilitating the management, delivery, and tracking of blended learning (i.e., on-line and traditional classroom) for students, employees, stakeholders, and customers. A robust system should integrate with other departments, such as human resources, accounting, and e-commerce; so administrative and supervisory tasks can be streamlined and automated and the overall cost and impact of education can be tracked and quantified.

Furthermore, the system should support a collaborative learning community, offering multiple modes of learning—from self-paced coursework (Web-based seminars and classes, downloadable, CD-ROM and video content) to scheduled classes (live instruction in classroom settings or online) to group learning (online forums and chats). In its ability to integrate, organize, and standardize learning across broad organizational requirements, the curriculum development, and instructional/learning management model has been compared favorably to enterprise resource planning (ERP) solutions, which convert a company’s back-office functions into a seamlessly functioning whole.

**Managing Class Data**

A curriculum development and instructional/learning management system provides a class roster for each teacher. Teachers with multiple classes or courses will have more than one roster.

### 2.4.3 Learning Management

**Student Achievement Profile**

This Web-based tool provides historical information for an individual student in the following areas:

- absences
- academic history
- assignment history
graduation information
marking period grades
student schedule
test scores

Academic Improvement Plan

The district is in the process of creating a web-based academic improvement plan (AIP). With a robust curriculum development and instructional/learning management system, all students can be provided with an AIP that is both diagnostic and prescriptive. The AIP is linked to the student achievement profile that contains a record of student mastery on standards as well as historical information. The achievement profile is an input into the diagnostic portion of the plan that contains data from FCAT, benchmark assessments from Edusoft, ILS data, classroom assessments, etc. This data, combined with teacher observable information, can pinpoint student weaknesses and strengths. The AIP can also be linked with other standards-based plans (e.g., IEP, LEP, 504, etc.).

Student Online Assignment Book

The student portal contains a summary of assignments made by his/her teacher(s) for the week and a calendar that provides access to future or previous assignments. It points to the assignment itself, which may include links to resources needed to complete the assignment. This information is also available to the student’s parents/guardians. The student portal also supports a “to-do” list and the ability to make notes about the assignment.

Online Assignment Management

Students are able to create, manage, and store work using their personalized portal and publish their work to the teacher by placing completed assignments in a class workspace, through e-mail, or by uploading to their portfolio (see “Student Portfolio section below). Teachers can assign a group workspace for students working together on a project.

Student Portfolio

All information about a student’s work products can be stored in an online portfolio. It tracks assignments, submission of work (date), and the assessment of student work. The online portfolio links directly to examples of each child’s work product.
2.4.4 Assessment/Evaluation Management

Assessment

A curriculum development and instructional/learning management system supports a comprehensive student assessment solution (classroom-based and diagnostic/predictive) that can assist educators in meeting the state’s standards-based accountability requirements.

Edusoft, the district’s online assessment tool for delivering interim/benchmark assessments, should be integrated into the full solution. Formative assessments are probably the most effective means for analyzing student data to improve student achievement. Frequent testing and assessments that are aligned with state and national standards provide teachers with the data to monitor current students and the ability to make adjustments.

In addition, the system also should provide traditional and non-traditional (e.g., portfolio, authentic, etc.) forms of assessment to ensure the use of appropriate strategies according to the types of skills and knowledge to be evaluated. The use of multiple assessment strategies ensures that various student learning styles are recognized and addressed, and that different strategies are necessary depending upon the nature of the designated student learning objective. Assessment tools provide test creation, storage, delivery (online, printed), processing (scanned or entered online), analysis, and reporting of results.

Standards-based/Traditional Gradebook

The district’s Web-based gradebook, Pinnacle, will be accessed from within the system to enable teachers to track student achievement using both traditional scoring and standards-based methods. It will be configurable for all levels (elementary, middle, and high).

2.4.5 Achievement Analysis and Reporting

The extensive reporting requirements and student achievement goals of the No Child Left Behind Act have many states investing millions of dollars to build data mining systems that will provide educators with student information that will help them to improve student achievement. Developing data systems that analyze student performance, identify gaps in curricula, and spotlight instructional practices or interventions for individual students is an important element for consistent and sustained student achievement.
Linking data to higher student achievement may be done in three steps:

- **Stage one**—collecting, organizing, analyzing, identifying findings, and developing action plans. Understanding should be given to the limitations of the data, the context in which the data were collected, and the implications of collecting additional data for further analysis.

- **Stage two**—analyzing data for improved efficiency. Most school systems at stage-two development are focused on short-term student achievement gains.

- **Stage three**—analyzing data for sustained student achievement.
3.0 TEACHING AND LEARNING TECHNOLOGIES

Included in the Technology Blueprint are a number of Major Recommendations. The purpose of this section is to provide a summary of the research and best practices information available to support those recommendations. The major recommendations related to Teaching and Learning Technologies are:

- TLT-1: Establish Selection and Acquisition Guidelines
- TLT-2: Attain and Maintain Technology Access Equity
- TLT-3: Expand Outreach and Communication
- TLT-4: Embrace Adaptive/Assistive Technologies in Support of AYP
- TLT-5: Establish Information and Technology Resource Centers
- TLT-6: Implement Web-based Textbook Management System
- TLT-7: Revise and Disseminate Acceptable Use Policy and Internet Safety Standards
- TLT-8 Expand Virtual/Online Opportunities for All Students

In support of these recommendations, the following information presents current research and best practices for the topics covered in Chapter III—Teaching and Learning Technologies. To facilitate navigation of the information in this section, the following is a table of contents for this section:

- Instructional Applications
  - Selection and Acquisition Guidelines
  - Software Categories
  - Software Selection Criteria/Factors
  - Identification, Review, and Purchase
  - Free Resources Available on the World Wide Web
  - District Initiatives

- Technology Utilization
  - Access
  - Equity
  - Critical Mass
  - Internet Access

- Special Populations
  - Students At Risk
  - Title 1
  - Special Education
Bilingual, Limited English Proficiency (LEP), and English as a Second Language (ESL)

Gifted Education

Career and Technical Education

Information Technology Resource Centers

- Web-based Management System
- Library Management Systems
- Research and Information Literacy
- Acceptable Use Issues
- Distance Learning and Virtual Resources
- Web-based Resources

The federal No Child Left Behind (NCLB) legislation requires that schools and districts across the nation invest their federal funds for student achievement on strategies that are scientifically proven best practices. The following information presents current research and best practices for the topics covered in Chapter III, *Teaching and Learning Technologies*. These topics include:

- TLT1 Instructional Applications
- TLT2 Technology Utilization
- TLT3 Special Populations
- TLT4 Information and Technology Resource Centers

In addition to nationally researched approaches, the current work of the district and the state of Florida are reflected in this body of knowledge.

### 3.1 Instructional Applications

#### 3.1.1 Selection and Acquisition Guidelines

The research and best practice information in the following section supports recommendation TLT-1: Establish Selection and Acquisition Guidelines.

The district seeks to develop standards, selection criteria, acquisition guidelines, and implementation/integration strategies for software applications for both the Windows and Macintosh operating systems in a broad range of categories.
3.1.2 Software Categories

- learning systems with management components including ILS, portals, and Riverdeep-type applications
- productivity tools including word processing, spreadsheet, database, note taking, (Notebook/Notetaker-pc, OneNote-mac), concept mapping (Kidspiration/Inspiration)
- production applications including Web design, presentation, desktop publishing, video production (iMovie), graphic design/imaging, photography (iPhoto), CAD/CAM drafting/design
- communications applications including browsers and e-mail (FirstClass)
- keyboard application for grades pre-K-8 and adult learners
- data manipulation applications
- content specific curriculum software programs
- test preparatory applications (FCAT Explorer)
- Web-based resources including subscription services and online teacher resources
- online learning communities (Blackboard)

3.1.3 Software selection criteria/factors:

- quality of assessment component and capacity to export this data
- quality of curriculum content and alignment with Sunshine State Standards
- depth and breadth of content (applicability for remedial and advanced learners)
- scientifically based research foundation of application
- ease of use
- online access
- technical requirements (computer, peripherals, bandwidth)

To assist district leadership with the identification, review, and purchase of digital instructional content, the following steps are recommended at the district level.
3.1.4 Identification, Review, and Purchase

- Identify and select developmentally appropriate applications for grades pre-K-12 that align with the Sunshine State Standards while supporting and enhancing the current productivity application.
- Research, review, and analyze best-practice strategies and accompanying applications.
- Determine which digital, instructional resources, beyond the productivity suite, are desired by most district schools (differentiated by primary, elementary, middle, high school, and adult audiences).
- Formulate guidelines and processes for individual schools to investigate and implement alternative software solutions for specific audiences/needs/learning groups.
- Coordinate vendor demonstrations of instructional technology applications at convenient sites throughout the district.
- Negotiate high volume purchasing agreements (district/school site licenses, lab pack discounts, and multi-user subscriptions) with those vendors who distribute desired learning resources.
- Develop dissemination strategies for making teachers aware of these resources and their intended use.
- Distribute procedures for securing applications/subscriptions at these prices to all schools.
- Disseminate to all schools links of free digital content available on the World Wide Web that aligns with district curriculum standards.

Software purchasing strategies will take into consideration volume purchasing, district, and network licensing to maximize the audiences with access to these learning resources. These efficiencies are discussed further in Chapter XIV, *Budget, Funding Sources, and Total Cost of Ownership*.

It is critical that communication and dissemination channels be developed to distribute selection criteria and acquisition guidelines widely to all audiences currently purchasing instructional applications.

The district also seeks to develop standards, selection criteria, and integration guidelines for free resources available on the World Wide Web.

3.1.5 Free Resources Available on the World Wide Web

- museum, government, education, and historical sites
- online learner productivity utilities
• student research portals and tools
• Web quests and Web scavenger hunts
• Web cam sites
• online learning communities
• online tutors
• student activities and templates

An expanded list of free Web-based resources can be found in the following section.

3.1.6 District Initiatives

The M-DCPS has begun the implementation of Riverdeep® Software’s Destination Reading, Destination Math, and Science software on a district-wide basis. These projects are supported by a strong research base recommending their use in strengthening students' basic skills and achieving school and district AYP goals. The development of Destination Reading was based on extensive formative research, including observations, interviews, and pilot tests. These results were used to ensure that fine-tuned literacy goals and the interface were age-appropriate and user-friendly. The software was field tested in twenty schools across five states with teachers using the product in a variety of ways: learning center, computer lab, individual student assignment, remedial activity, or supplemental activity. The software received consistently high ratings for student engagement, educational approach, grade appropriateness and story quality. 4

Six separate validation studies for Destination Math were conducted at schools around the country. The studies included longitudinal and cross-sectional analyses. Some used Destination Math as the performance indicators, others used another standardized test, such as the Massachusetts MCAS test. All demonstrated statistically significant performance improvement by students who had used Destination Math to prepare for the test. Anecdotal reports from students and teachers cite students having a much better comprehension of specific concepts which were previously difficult to master, a more enjoyable math experience, and an improved attitude towards learning.5

The Intel Thinking Tools® are a set of Web-based, interactive tools that promote problem-solving and critical-thinking skills using a constructivist approach. The “Visual Ranking” tool takes a visual approach to analyzing information and setting priorities. The “Seeing Reason” tool helps students to map cause-and-effect-relationships. The “Showing Evidence”

tool helps students to develop a hypothesis, identify, and evaluate supporting evidence, and use that evidence to support or debate their claim. These tools are Web-based and available to all educators at no cost; user support is provided by Intel.6

3.2 Technology Utilization

A high-speed and reliable WAN infrastructure enables the district to employ multiple options to distribute technology utilization strategies to teachers. These strategies include digital content selection guidelines, successful integration strategies, technology-supported programs, and models for addressing the needs of at-risk students from pre-K through grade 12. Digital content selection guidelines that are designed to assist teachers in the selection of technology-based resources and are differentiated by instructional levels and content area will be reviewed and updated regularly. Staff development linked to selection guidelines will be designed and offered. The majority of classrooms currently not connected to the district network include the many portables/relocatables within M-DCPS. Alternate options for disseminating technology utilization strategies will be developed as wireless network plans for portables/relocatables are implemented.

Strategies for creating effective blended technologies learning environments will be documented and disseminated (print and electronic). These strategies include the use of alternative desktop computing devices such as portable writing keyboards, graphing calculators, laptop, and portable computers. Teachers who have used these devices and are willing to work with others will be identified to facilitate effective integration into classroom activities. This mentoring will be provided remotely via e-mail.

Access to district instructional technology resources may be increased by promoting partnerships with childcare service providers offering before-school, after-school, and weekend programming for M-DCPS’ students.

3.2.1 Access

The research and best practice information in the following section supports recommendation TLT-2: Attain and Maintain Technology Access Equity.

M-DCPS leadership understands the importance of providing access to resources and information to all individuals within the district. It acknowledges the need to attain equity with respect to the quality of services and resources it offers as part of the learning environment.

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Likewise, it realizes the need to achieve critical mass in learning technology resources to provide on-demand access for all M-DCPS’ learners.

Acquisition and management of technology resources address both access and equity issues. Access refers to the students’ ability to use instructional technologies to enhance/support learning about and with technology. Access is linked to several important variables:

- the number of computing devices (generally evaluated in terms of a student-to-computer ratio)
- the location, configuration, and scheduling of technology resources
- the mobility and flexibility of selected technologies
- the use of networking and/or telecommunications to transcend classroom and school geographical boundaries
- the proficiency of teachers and administrators who can support technology integration and guide instruction

Access is a challenge for multiple audiences within M-DCPS. Educators require access to information and resources to make instructional decisions that allow their students to improve their academic achievement and attain adequate yearly progress (AYP). Administrators require access to information and resources so that they can better report, manage, and evaluate student data. Learners require access to information and resources to acquire content knowledge, information literacy, and 21st century skills.

3.2.2 Equity

Equity deals with the funding approaches and decision-making processes by which schools acquire and use instructional technology resources and the fair and equitable distribution of those resources.

The efficient acquisition and management of technology resources will help ensure that:

- schools attain computing devices that meet or exceed district standards
- all students have access to current, appropriate, and sufficient information resources
- existing resources are used to their maximum potential so that future dollars are spent in areas of greatest need
- all schools attain a sufficient infusion of instructional technologies to attain district goals through local implementation solutions
- strategies are employed to engage all learner populations
With respect to addressing equity in learning issues with specific learning populations, best-practices research substantiates the following technology integration strategies:

- the use of project-based learning to engage girls in attaining information literacy skills (refer to section II, Chapter 1.2 on Project Based Learning to address gender issues)  

- the integration of digital video production to engage multiple voices and representations of students in the process of learning science.

- the use of adaptive/assistive devices and universal design models to provide equitable access to digital content for all learner populations.

- activating operating system (OS) accessibility features available in Windows, Mac OS, and Linux including:
  - accessibility wizard
  - screen and audio magnification
  - screen contrast
  - display
  - text-to-speech
  - voice/speech recognition
  - visual alerts
  - audio alerts
  - sticky keys
  - repeat/filter keys
  - mouse
  - mouse keys run together
  - shortcut keys
  - serial keys

M-DCPS currently employs or is actively investigating a number of strategies to improve and increase access to technology resources (many of these strategies are described in greater detail throughout the Information Technology Blueprint chapters). Examples of these strategies include:

- investigating thin client options (Chapter IV. Learning Environments and School Facilities)

- investigating alternative computing devices (Chapter IV. Learning Environments and School Facilities)
• developing technology access points within the community (in schools, public libraries and community organizations such as boys/girls clubs) for after-school and weekend access to technology resources (Chapter IV. School Facilities and Learning Environments, and Chapter XII. Community Access and Participation)

• investing in Web-based applications that require only Web-browser software for access and use

• refurbishing and recycling older computers into the homes of Miami-Dade families

3.2.3 Critical Mass

M-DCPS seeks to review, define, and embrace approved critical mass configurations for classrooms and learning environments at all levels. Critical mass is defined as that level of technology infusion sufficient for measurable gains in student performance.

Reaching critical mass in technology resources for M-DCPS means that over the course of the next three budget cycles, student-to-computing device ratios will reach the following:

• grades K to 5 – 2:1 (providing on-demand, one-to-one access within the school environment)

• grades 6 to 12 – 1:1 providing 24/7 one-to-one access

• fifteen computers per elementary school information and technology resource center

• thirty or more computers per secondary school information and technology resource center

Critical mass of technology resources accompanied by training, support, building-level leadership and vision, and effective planning are essential for the district to realize measurable gains in student performance from implementation of M-DCPS strategic and technology planning efforts. Accordingly, the district will develop a master procurement/allocation plan for achieving the goal of one computing device for every student, the equipment to be located predominantly in classrooms and the information and technology resource center while it upgrades or replaces obsolete equipment.

District leadership has expressed the need to expand home/school communications as well as availability of educational resources through electronic linkages to families with access from home, community locations, and libraries. The district is considering the implication of acquiring these resources and seeks to determine appropriate instructional resources to be made available for after-hours student community access. Web-based strategies for community access and dissemination will be developed. Community information and resources
are being developed in several languages to target M-DCPS adult community. Availability of information and educational resources as well as directions for access will be publicized. Initially, educational resources will target literacy skills.

It is important to recognize that in highly effective learning environments, one-to-one student to computer access is often a requirement. The ratios stated above do not imply a distribution strategy or any specific configuration. A blend of desktop computers, portable computers, tablet computers, hand-held computers, calculators, and other alternative computing devices may add the mobility and flexibility to bring on-demand 1:1 access into classrooms as needed.

Workstations are not the only critical mass components. Table 3-1 below shows the critical mass for a variety of equipment for typically sized elementary, middle and high schools. Adjustments will be made for schools significantly larger or smaller than average for the level.

The average school sizes for M-DCPS are:
- elementary schools (pre-K-5) average 825 students
- middle schools (6–8) average 1,500 students
- high schools (9–12) average 3,000 students

Table 3-1. Critical Mass

<table>
<thead>
<tr>
<th>Area</th>
<th>Unit of Measure</th>
<th>Elementary</th>
<th>Middle School</th>
<th>High School</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Classroom Technology</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laptop</td>
<td>per Student</td>
<td>0.2</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Handheld Computing Device</td>
<td>per Student</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Elementary Learning Device</td>
<td>per Student</td>
<td>0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Learning Device</td>
<td>per Student</td>
<td>0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laptop</td>
<td>per Teacher</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Color Scanner</td>
<td>per Classroom</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Digital Camera</td>
<td>per Classroom</td>
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<td>1.0</td>
<td>1.0</td>
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<tr>
<td>Ceiling Mounted Projector</td>
<td>per Classroom</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Interactive White Board</td>
<td>per Classroom</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Mounted Speakers/ Sound</td>
<td>per Classroom</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Media Control Panel</td>
<td>per Classroom</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Printers-networked Colored Laser</td>
<td>per Classroom</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Recharger Cart</td>
<td>per Workstation</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Area</td>
<td>Unit of Measure</td>
<td>Elementary</td>
<td>Middle School</td>
<td>High School</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
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<td>---------------</td>
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</tr>
<tr>
<td>Telephone Instrument</td>
<td>per Classroom</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Staff Development</td>
<td>per Teacher</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Other Equipment Upgrade/Replacement</td>
<td>per Classroom</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Information and Technology Resource Centers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Library Workstations</td>
<td>per School</td>
<td>15.0</td>
<td>30.0</td>
<td>30.0</td>
</tr>
<tr>
<td>Advanced Multi-Media Workstations</td>
<td>per School</td>
<td>1.0</td>
<td>3.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Telephone Instrument</td>
<td>per School</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>File Server for media storage and distribution</td>
<td>per School</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Distance-learning Classroom</td>
<td>per School</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Video Production &amp; Broadcast Studio</td>
<td>per School</td>
<td></td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Offices</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workstation/Laptop</td>
<td>per Administrator</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Workstation/Laptop</td>
<td>per Instructional Support Staff</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Workstation</td>
<td>per Non-Instructional Support Staff</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Telephone Instrument</td>
<td>per Office</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Printers-networked Black/White Laser</td>
<td>per Office</td>
<td>1.0</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>School</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wide Area/ Internet/ Telephone Connections</td>
<td>per School</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Sheet Feeding Scanner</td>
<td>per School</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Large Screen Projectors</td>
<td>per School</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>File server for networked services</td>
<td>per School</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Wired Infrastructure</td>
<td>per School</td>
<td>1.0</td>
<td>1.2</td>
<td>1.4</td>
</tr>
<tr>
<td>Wireless Infrastructure</td>
<td>per School</td>
<td>1.0</td>
<td>2.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Telephone/Voice Mail System</td>
<td>per School</td>
<td>1.0</td>
<td>2.0</td>
<td>3.0</td>
</tr>
<tr>
<td>File server for storage/printing</td>
<td>per School</td>
<td>1.0</td>
<td>2.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>
The table provided presents rough guidelines for determining the critical mass of technology needed for a school overall and for budgeting. It is not intended to dictate the distribution or placement of resources within a school or to suggest that more than this level of technology is ineffective or unnecessary. To meet class size reduction targets, many schools are shifting existing computers from labs to classrooms, preserving labs when possible and appropriate to learning needs.

Existing technology will be replaced or refreshed when it no longer enhances the teaching and learning processes in classrooms and labs. Although not explicitly addressed, the deployment of assistive/adaptive devices for special needs populations will be included based on the populations serviced by the school and the dictates of Individual Education Plans (IEPs).

3.2.4 Internet Access

The research and best practice information in the following section supports recommendation TLT-3 Expand Outreach and Communication.

M-DCPS seeks to provide all learners within the district access to robust Internet resources from school, home, and community. Multiple variables present multiple challenges to this formidable target. These challenges include differences in:

- response time between current infrastructure in facilities at elementary schools, middle schools, high schools, and technical centers
- electrical and network capacity found in older facilities versus newer construction
- network access and strategies for portable classrooms

In an effort to re-engage non-traditional students in learning, M-DCPS seeks to expand Internet access beyond the traditional school facilities. Sites to be integrated into our expanded vision include learners in:

- alternative schools
- hospitals and homebound settings
- magnet schools

Pew Foundation studies reveal that equity of access to the Internet alone, both in school and from home—although critical to 21st century student achievement—is not enough to overcome disparities outside of the school environment. Students in all learner groups require explicit instruction on effective uses of the Internet, efficient search strategies, and appropriate
interaction with and interpretation of Web content\textsuperscript{9}. The emerging integration of blogs and online applications into daily classroom practice, projects, and activities further support the need for robust Internet access for all learners.

As M-DCPS achieves its goal of expanding Internet access to increasingly larger audiences, technology leadership faces the challenge of:

- implementing filtering strategies that comply with CIPA guidelines
- educating teachers about Web sites and strategies for identifying plagiarism in student projects, presentations, and papers
- educating students about appropriate documentation guidelines and online citation generators

Leonardo da Vinci said, "The apprentice who does NOT outstrip his master fails him." M-DCPS educators must feel comfortable with and enabled to empower their students to become greater masters of the power and potential the Internet has to offer than they themselves may ever achieve. But it is critical that this mastery include use of such a pervasive resource in a responsible and accountable fashion.

### 3.3 Special Populations

The goal of the Elementary and Secondary Education Act (ESEA) has always been equity. Since its inception in 1965, ESEA has emphasized the need for all students, especially those at risk, to achieve to their fullest potential. This was evident in 94-142 Special Education legislation in the Improving America's Schools initiative\textsuperscript{10} and continues to be the focus of NCLB. As currently implemented, NCLB adds the components of assessment and accountability into the "equity equation" for all M-DCPS learners, including disaggregated and special populations.

Unique instructional strategies that incorporate technology-based solutions abound for students served in the district's special programs. These programs address the needs of students identified as at-risk, special education students, those students receiving Title 1 support, and students with bilingual and/or ESOL challenges. The largest special programs within M-DCPS include special education, bilingual education, and Title 1 programming.

Miami-Dade instructional leadership seeks to address the unique learning needs of all students within the district. Frequently, technology solutions are a way to motivate and engage the disengaged student, level the playing field for the special education student, and challenge the gifted learner.

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\textsuperscript{9} "Pew/Internet: Pew Internet & American Life Project." Pew Internet & American Life Project
A non-profit research center studying the social effects of the Internet on Americans: http://www.pewinternet.org/ (Accessed April 2004).

The subtopics included under this topic include:

- Students at Risk
- Special Education
- Bilingual and ESL
- Gifted Education
- Career and Technical Education

### 3.3.1 Students at Risk

At-risk populations, especially those not attaining AYP, are primary targets for ensuring regular access to technology resources and increasing technology use as many of these students have limited, if any, access to these resources in their home environment. In the areas of math, science, and technology, virtually all girls are at-risk. To address this audience, M-DCPS will investigate programs such as CyberSisters, an innovative tele-mentoring program at the University of Oregon (Eugene-Springfield) and Oregon State University (Corvallis). CyberSisters is achieving success by focusing on the hands-on use of technology to promote girls' interests in science and math by pairing girls and university women who possess strong backgrounds in those areas. Research has also established best practices with girls, project-based learning (PBL), and technology.\(^\text{11}\) Other such models exist for students at risk of dropping out of school and for disenfranchised populations.

To encourage teachers who are most likely to interact with at-risk populations, technology resources will be:

- easy to access, set-up, and use
- in good working order
- portable, flexible, and robust to meet the unique needs of at-risk students
- engaging and exciting for students

M-DCPS will research and disseminate (via the district Web site) successful strategies, programs, and models for addressing the needs of at-risk students from pre-K through grade 12 by:

- defining and identifying the district's at-risk populations
- determining criteria for selecting at-risk populations that can benefit from technology-enhanced interventions
- aligning technology-enhanced interventions with at-risk populations
- creating and disseminating assessment strategies to align individual at-risk students with the most appropriate intervention

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3.3.2 Title 1

Title 1 funds have been used from the onset to ensure that all students, regardless of their socio-economic background, attain reading literacy skills. These funds are targeted at young learners, often from urban and/or rural areas with low-socio-economic conditions that did not allow for the foundation skills critical to reading literacy. When learning technologies entered our primary classrooms, initially as drill and practice tools, many educators realized the potential for addressing reading literacy with Title 1 students. As learning technologies have evolved with respect to sophistication and diversity, a much wider offering of solutions is available to address reading and literacy challenges.

Title 1 decision makers in M-DCPS will consider the following guidelines:

- Make technology support staff and technology resources available to Title 1 students beyond the regular school day for research, remediation, homework, and project work; few, if any, have access to these resources in their home environment.

- Implement strategies, such as workshops and seminars for parents to acquaint them with ways technology can enhance their children’s reading literacy skills and their own learning.

- Provide sufficient professional development and ongoing technology support so that all reading teachers are comfortable using technology resources to enhance reading and writing instruction.

- Investigate and offer online courses for reading teachers such as those by Classroom Connect, Holt, Rinehart and Winston, Pearson Professional Development, and Riverdeep.¹²

- Disseminate a listing of locations in the community where students and parents can access technology.

- Provide access to technology through grants and donations of used and/or recycled equipment to parents of Title 1 students.

The identification of strategies to address the needs of Title 1 populations will be included in school improvement plans and will require the following:

- Research-technology resources and technology-integration strategies that have proven effective in meeting the needs of Title 1 student populations.

- Dissemination of best practices and successful strategies in print and electronically via the district Web site.

- Monitoring and assessment approaches to evaluate the implementation and effectiveness of select strategies in M-DCPS schools.

3.3.3 Special Education

The research and best practice information in the following section supports recommendation TLT-4 Embrace Adaptive/Assistive Technologies in Support of AYP.

Technology solutions and strategies assist both Miami-Dade teachers and students in the area of special education. To enable the academic growth and development of special education students, a variety of adaptive and assistive devices/techniques are deployed to help equalize the learning environment for specially challenged learners. In the near future, M-DCPS will be implementing the Instructional Planning System (IPS) that links to the district student information system (ISIS). It is a special education management tool designed to develop Individual Education Plans (IEPs), manage special education reporting and assessment requirements, and monitor student attainment of their individual goals and objectives.

Special education leadership may choose to investigate a hand-held, computer-based solution for itinerant teachers that link into the state database of all special education resources. This hand-held solution provides standard pull-down menus of choices and resources and enables the district and state to track the deployment of their adaptive and assistive resources.

The district's special education program provides a diverse array of services to achieve the goals articulated in these IEPs for all special needs students. Adaptive and assistive technology resources continue to play a significant role in helping to equalize learning environments for special education students. Some of the technologies used to aid the educationally challenged student in the classroom include:

- text-to-speech programs that use a digital voice and read text aloud from software applications, e-books, or Web-delivered content
- word prediction applications that present up to nine different possibilities once the writer begins to type
- portable keyboards, alternative keyboards, and switches to simplify the mechanics of the writing process
- concept-mapping software that presents information, both in graphic and in outline format
- electronic manipulatives that are digital versions of objects used to demonstrate math concepts such as tangram blocks to create a design or dice to solve a probability problem
It has been demonstrated that students with learning challenges benefit when using technology-integrated strategies and resources as illustrated below:

- Students with attention deficit/hyperactivity disorder (ADHD) benefit from using multimedia, desktop publishing, outlining (such as Inspiration© or Kidspiration©), and word-prediction software to allow for divergent thinking while providing a resource to organize their thinking.

- It has been observed in students with behavior disorders that computer-based activities often provide motivation and tend to lessen acting-out behavior patterns. Word processing and word prediction programs also tend to reduce stress and frustration levels during writing tasks in this student population.

- Students with oppositional defiance disorder and autism respond positively to the creation of micro-environments or mini-societies and movie production within the special education classroom. These activities are focused on the positive aspects of the student's lives and demonstrate to the students that they are truly unique and extraordinary.

- The autistic student may benefit from being allowed to tape presentations instead of having to present them in front of a live audience. Keyboarding or taping to reduce the stress of touching pencils is also a successful strategy with this population. Text-to-speech and color adjustment features may prove beneficial as well as including computer-generated illustrations for presenting complex concepts.

- To help the hearing or visually impaired student compensate, assistive listening devices to increase volume and clarity as well as low-vision devices, such as big screens, text-to-speech, and large keyboards are available. Color and volume settings on the computer can be adjusted for higher contrast and louder sound output.

- Students diagnosed with emotional/behavior disorder (EDC) find that using word processing to write and revise written work helps to prevent outbursts. Graphic organizers may also reduce stress in the learning environment. Allowing these students to discover the wonder of software applications and content on the Internet can produce significant rewards.

- Strategies that focus on the ergonomics of the learning environment help the special needs student with significant development delay (SDD). These strategies include positioning the computer low enough for the student's feet to touch the ground, placing the monitor at eye level, using a timer to practice sharing, providing headphones to eliminate distractions, adjusting control-panel settings for the mouse and keyboard, and securing larger keyboards for easier typing.
• Current Macintosh, Microsoft, and Linux operating systems are designed with control features for the visual display, audio feedback and text-to-speech that in the past needed to be purchased as add-on applications. These accessibility options can be grouped into the following categories: (1) solutions for visual impairments; (2) solutions for hearing impairments; and, (3) solutions for mobility impairments.  

Many school districts across the nation are embracing the universal access/universal design model that employs a proactive strategy to making print and digital content more readily accessible to special education students and any other students experiencing learning challenges. The universal access/universal design model employs the following strategies:

• placing text-to-speech programs and other assistive applications on a select percent of all instructional computers in each school and designating them with a visual identifier

• securing and/or scanning all school texts into digital format so that all students can read (with text-to-speech assistance if needed) grade appropriate textbooks in all disciplines

• ensuring that district Web pages adhere to federal accessibility guidelines for the visually impaired

Before a formal evaluation has been conducted, the universal access/universal design model provides educators with a number of interventions that can be tried immediately with any student experiencing learning difficulties and in some cases may provide all the remediation needed for that student to be successful.  

Many resources are now available for developing instructional materials and Web sites that embrace the universal design concept and include the following:  

• CAST, Center for Applied Special Technology at http://www.cast.org

• Bobby, get your Website "Bobby Approved" at http://www.cast.org/udl/Bobby215.cfm

• Web Content Accessibility Guidelines 2.0 0 at http://www.w3.org/TR/WCAG20

• Section 508 of the US Rehabilitation Act at http://www.section508.gov

• Designing for a More Usable World–for All at http://trace.wisc.edu/world

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3.3.4 Bilingual, Limited English Proficient (LEP), and English as a Second Language (ESL)

The bilingual education dialogue, its effectiveness, onset of programming, duration of programming, and the determination of best practices continues at the national level. M-DCPS leadership will monitor this dialogue and the ensuing research that is being released from longitudinal studies in states such as California and Texas. Trends continue to emerge regarding the role that learning technologies can and should play in the bilingual classroom. Some of these strategies:

- Employ learning technologies that support authentic communication and intellectually challenging tasks in both English and the learner's native language (too often bilingual software has focused on drill and practice activities, rather than higher-order communication and thinking skills).

- Ensure that computer-assisted language learning engages and interacts with students in a larger social context, including activities such as theme-centered, multimedia slide shows; electronic hypermedia books; and poetry.

- Develop a standardized, centralized bank of assessment tasks that are grounded in academic content standards and are specific to students with limited and/or emerging English proficiency. These tasks would focus on interrelated activities relying on graphic and visual content and orally delivered support rather than on dense text. These assessment items would be used to determine the attainment of curriculum standards.

- Incorporate technology to graph real-life data and explore relationships between data and graphical representations.

Using technology as a learning tool rather than primarily for drill and practice allows the bilingual student to develop language skills in relation to the computer and other 21st century digital tools.

In the area of bilingual education, M-DCPS will embark on a process of:

- researching national technology initiatives in the area of bilingual education
- recruiting colleges in the M-DCPS area to assist the district with conducting this research study locally
- expanding and implementing promising practices and successful strategies
- employing technology-enhanced strategies, where appropriate, to support instruction for the bilingual population and their families

Beyond the challenge of the regular classroom teacher, the bilingual technologist (the bilingual, technology-wielding teacher) must ensure that the experiences of bilingual students with computers are equal or superior in quality to those of monolingual students. The fact that many of these
minority students face two barriers to learning and lifelong productivity – lower socio-economic background and limited English proficiency (LEP) – demands that we integrate a wide variety of blended learning technologies into the bilingual classroom.

### 3.3.5 Gifted Education

Individualizing instruction for the gifted learner is as much the responsibility of M-DCPS as providing for the educationally challenged. The availability of teaching and learning resources offered via the district network and/or from the Internet has significantly increased the options to teachers for addressing the needs of this audience. Technology-supported strategies that address the learning needs of and challenge the gifted learner include:

- online college and university courses
- distance learning and virtual education Advanced Placement courses (for example, Florida Virtual High School)
- online activities, projects, challenges, contests, and competitions
- access to experts in all content areas (mathematicians, scientists, engineers, writers, musicians, artists, curators, lawyers, doctors) for assistance with research, review, recommendations
- individually paced ILS programs for advanced concepts and theory
- simulations for sophisticated discovery and exploration-based learning and problem solving
- Internet-based data collection and research projects working with global research teams
- audio and video production capacity for students to express themselves through both music and visual imagery

Exceptional qualities appear in a wide array of areas – the sciences, the arts, the humanities – and can usually be found within each learner. Identifying that gift or talent and tapping into its potential to allow each individual to use it to its fullest advantage is the challenge for the educator of the gifted learner.

### 3.3.6 Career and Technical Education

Career and technical education programs have experienced an enormous transformation over the past twenty years from a hands-on curriculum that focused primarily on mechanical, manufacturing, carpentry, housekeeping, childcare, and healthcare to a high-technology curriculum that employs technology tools and resources found in real world business and industry. Technology resources and the accompanying environments available for the 21st century career and technical student to attain critical life skills are numerous. Career and technical programs
offer certification programs in automotive repair, cosmetology, childcare, allied health services, networking, computer repair, technology training, and computer programming.

Students within the career and technical academies are likely to experience the following technology-based environments:

- CAD/CAM design and manufacturing devices
- computer-aided automotive diagnosis and repair systems
- crisis management and medical emergency simulations for childcare providers and emergency care first responders
- business planning and project management applications
- meteorological, atmospheric, environmental, climactic data on the Web for agricultural and aquacultural planning
- commercial quality print, graphical, photography, video production resources

M-DCPS seeks to provide superior educational experiences for students who desire to enter the world of work immediately after completing their K-12 education. Community-based partnerships assist the district with providing internships, visitation sites, interview experiences (both in person and via video conferencing), exposure to state-of-the-art technologies in their chosen field, and hands-on experiences in a real-world setting in the career and technical education programs. These partnerships are described in greater detail in Chapter XII: Community Access and Participation.

3.4 Information and Technology Resource Centers

The research and best practice information in the following section supports recommendation TLT-5: Establish Information and Technology Resource Centers.

District leaders and library media specialists share a vision of transforming school libraries into a hub of information and technology access. In order for libraries to survive and grow into Information and Technology Resource Centers, the district seeks to reaffirm their critical importance. District-wide, these centers will also become a priority in the networking process and be upgraded with enough appropriate technology to enable them to provide Internet access and enable libraries to support voice, video, and data (electronic and hard copy) information resources. Additionally, while many of the existing libraries and media facilities have structural, electrical, and spatial constraints, new construction and renovations of older schools will place a high priority on creating such centers.
Most district Information and Technology Resource Centers not only provide resources locally but also enable students and staff to access learning materials from across the country and the world. All centers are automated and have high-speed access to the Internet and will offer these components:

- locally warehoused books, papers, photographs, software, videos, and CD-ROMs
- electronic virtual library access systems by which a user may transparently connect to remote libraries, databases, and other holdings by using the Information and Technology Resource Centers’ online system including the Florida statewide catalogue, Sunlink

The district’s instructional leadership seeks to provide Information and Technology Resource Centers materials in all schools that provide access to a developmentally appropriate array of digital and print content. Information and Technology Resource Centers staff seeks to play a pivotal role in helping teachers and students to attain Information Literacy skills and proficiencies. The subtopics included under this topic include:

- Library Management Systems
- Research and Information Literacy

### 3.4.1 Library Management Systems

In order to evaluate and refresh the current library management system, district leadership will review the following strategies:

- research and compare the current centralized system with emerging Web-based library management systems
- update and refresh computers within school Information and Technology Resource Centers
- provide equitable access to students and staff to information available over the network (e.g., district learning resources, approved Web sites, public library system, and accessible university library systems)
- develop and implement a plan and timetable for establishing a comprehensive media management system

The newest breed of library management systems is a centralized system that shares one common database throughout the district, replacing legacy distributed, site-based systems. Most of these centralized systems are Web-based, allowing access to the entire district collection from any district computer on the network with a current Web browser. The initial cost for centralized systems is projected to be high, but the total cost of ownership (TCO) will ultimately be lower than that of the older distributed systems. Centralized solutions reduce redundancy, are easier to maintain, increase reporting capacity, and provide easier access to
data that compares usage of collections across a district. The current industry leaders in centralized systems share many of these common Web based characteristics, requiring only a Web browser for accessing the LMS:

- use of standard formats for importing and exporting data
- SIF-compliant
- open-standards technologies such as SQL, ColdFusion, or XML
- no exclusive workstations on the network so that other applications may run simultaneously with the LMS
- access from other computers in the school
- generation of standard reports (collection size, circulation statistics, inventories, overdue notices, booklists sorting by various categories) and development of custom reports
- search of the OPAC and the Web simultaneously using a keyword search

In order for district libraries to be transformed into Information and Technology Resource Centers that support voice, video, and data (electronic and hard copy) information resources, their libraries require an automated and comprehensive library media management system that operates over the district's information technology system.

A comprehensive system will enable students, teachers, and administrators to access information resources over the network, search databases, reserve video resources, and request information sources. Key to the success of the 21st century Information and Technology Resource Centers is its access from any workstation in any building via the network. Also, information processing tools will be employed to transform information into more readily usable formats.

A district-wide library management system minimizes unnecessary duplication of holdings across schools, allowing individual libraries to develop specialized, in-depth collections. Electronically linking the entire district's collections would make valuable resources easily accessible to any student, teacher, or administrator. These strategies will ensure that students are able to:

- access electronic card catalogues and bibliographic databases within and among schools
- perform interlibrary loans, both among schools and with public libraries
- access to databases within the school, at other schools, and at district offices

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• access to digital resources (Encyclopedia Britannica, Grolier's, etc.)

Increased efficiency and accuracy can be incorporated into current cataloging processes. Books will be purchased that are ready to be placed on shelves along with accompanying cataloging information in electronic form. Where this is not possible, and for non-print items, a fully networked catalog processing service will be implemented.

In addition to addressing automation upgrades and enhancements, the district will focus attention on promoting effective information models, providing professional development, and sharing practices and resources.

Information and technology resource center leadership seeks to:

• communicate to school leadership the important role of libraries as Information and Technology Resource Centers now and in the future
• provide school leaders with model configurations for technology-enriched learning environments for libraries
• ensure district-wide professional development plans and programs for school library media specialists and paraprofessionals to prepare them to manage technology-rich information resources and help students and staff use technology as a research tool
• assess success and replicability of existing models, practices, and resources, and expand the use of successful programs
• design resources to be Web-enabled and accessible by all computers at all school sites, and as appropriate, from home and community centers

District schools will investigate strategies to negotiate site licenses with publishers for electronic versions of their books and other print matter. This will enable teachers and curriculum developers to access these electronic books and periodicals, and assemble customized, standards-based teaching materials for use in the classroom. The district network has access to a variety of online databases such as the ProQuest for use by educators for professional development or classroom activities. Full text is available from many sources and can be stored on the local district server for easy access by school building personnel. Teachers and students have access to current news for research projects. With access to commercial news services, students will be able to search and browse over sixty newspapers, over 200 periodicals, and live news reports from sources such as the Associated Press.
3.4.2 Research and Information Literacy

Information Literacy Standards

The district has embraced the NETS•S standards that include competencies in technology use, technology integration, research skills, and data/information manipulation competencies. These information literacy standards, along with other nationally developed standards are included in Chapter II, Curriculum Assessment, of this Information Technology Blueprint collection. The Information Literacy Standards for Student Learning were developed in collaboration with the American Library Association (ALA) and the Association for Educational Communications and Technology (AECT) in 1998. These standards include nine standards that are grouped into three categories. In 1994, the International Technology Education Association (ITEA) launched the Technology for All Americans Project (TFAAP) to advance student attainment of technological literacy. In 2000, ITEA published its twenty Standards for Technology Literacy (STL) that are grouped into five categories. The 21st Century Learning Skills listed in the Learning for the 21st Century report, from the public-private coalition, the Partnership for 21st Century Skills (www.21stcenturyskills.org), identifies ICT (information and communication technology) literacy as a core element of their 21st Century Learning Skills. It is clear that school libraries will play an integral role in supporting the attainment of these information literacy standards.

Web/Information Literacy Programs and Strategies

One of the most popular information literacy models is called Big6. Developed by Mike Eisenberg and Bob Berkowitz, Big6 was and is one of the most widely known and widely used approaches to teaching information and technology skills in the world.\(^\text{18}\) It has been described as a meta-cognitive scaffold, or an information problem solving strategy. The Big 6 steps provide an essential framework to approach any information-based question.

The six steps include the following:

1. Define task
   1.1 Define the information problem
   1.2 Identify information needed in order to complete the task (to solve the information problem)

2. Information Seeking Strategies
   2.1 Determine the range of possible sources (brainstorm)
   2.2 Evaluate the different possible sources to determine priorities (select the best sources)

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3. Location and Access
   3.1 Locate sources (intellectually and physically)
   3.2 Find information within sources

4. Use of Information
   4.1 Engage (e.g., read, hear, view, touch) the information in a source
   4.2 Extract relevant information from a source

5. Synthesis
   5.1 Organize information from multiple sources
   5.2 Present the information

6. Evaluation
   6.1 Judge the product (effectiveness)
   6.2 Judge the information problem-solving process (efficiency)

More detailed information about this model can be found at the Big6 Web site at http://big6.com/

Role of the Information and Technology Resource Center Staff

Today's school librarian is sometimes called the cybrarian, or cyber librarian, for his/her expertise in locating information gold mines on the Internet. This school Information and Technology Resource Center specialist of the 21st century is comfortable with both ideas and technology and functions effectively in both print and electronic worlds.

The primary role of this specialist, to help students and teachers find information resources to support learning and instruction, has not changed significantly over the past one hundred years. But with the advent of technology, the tools of the trade have been revolutionized in the past twenty-five years. The 21st century cybrarian is facile at using technology to gather information, sift through it, categorize it, and organize it to meet the user's unique learning needs at a given point in time. He/she pursues facts, statistics, resources, and even people who have information on a specific topic.

Other functions of the 21st century school information and technology resource specialist include:

- evaluating hardware and software for usefulness and reliability
- developing databases for students and teachers
- bridging the gap between user behaviors and learner behaviors, such that all learners are effective seekers and users of information

The impact of these information specialists within our school libraries is significant. Recent studies have documented a significant correlation between the size of a school's Information and Technology Resource
Center and resource center staff and test scores. Students in schools with appropriate and sufficient information and technology resources (library collections and qualified staff) tend to perform better on standardized tests, especially in reading. Test scores increase as school librarians spend more time collaborating with teachers on providing training for staff and assisting with managing information.

3.4.3 Acceptable Use Issues

The research and best practice information in the following section supports recommendation TLT-7: Revise and Disseminate Acceptable Use Policy and Internet Safety

An acceptable use policy (AUP) is a formal agreement between the school district and the users and stakeholders of the Internet: administrators, teachers, students, and parents. Each year, the agreement should be read and signed by the user and a designee of the school and kept on file for accountability. 19

An AUP outlines the school’s expectations for the Internet, providing an overview of the services that are available, the responsibilities of the user, the activities that are considered infractions, and the consequences of violating these regulations. The following information might also be included in an AUP:

- a list of district personnel who are responsible for the school’s network infrastructure
- information about copyright, fair use, and Internet plagiarism
- a description of the district’s blocking and filtering policy
- the district’s virus protection policy and the use of personal diskette’s
- A disclaimer protecting the district from liability

3.4.4 Distance-Learning and Virtual Resources

The research and best practice information in the following section supports recommendation TLT-8: Expand Virtual/Online Opportunities for All Students.

Program Offerings

For a large district such as M-DCPS with state-of-the-art resources, the distance learning classroom is one solution to address needs of a broad range of learning audiences. A distance learning classroom centrally located within a school can provide instruction for students, staff, and community in the following areas:

Student Instruction

- offer traditionally low enrollment courses such as world languages including Latin and German
- conduct advanced placement (AP) courses as needed (math and science are popular)
- offer courses with national instructor shortages (Japanese, Russian)
- allow students-as-teacher opportunities with broadcasts from school to school
- provide students with opportunities to participate in global projects, attend real-time events, and communicate with experts in the field
- provide lessons tailored to specific learning styles.
- Allow students to take college-level courses while still in high school.

Teacher and Staff Development and Training

- secure nationally recognized speakers via satellite for professional development activities
- facilitate district discussions on local/regional/global issues
- broadcast town meetings and disseminate important information to the community

Videoconferencing

- minimize the need to travel among schools within the district for meetings
- facilitate curriculum development among staff at different schools or sites

3.4.5 Web-based Resources

Instructional content in the classroom is no longer limited to textbooks, stand-alone software applications, and manipulatives. District-wide networks with broad bandwidth access to the World Wide Web have
placed a wealth of digital instructional content at the fingertips of any teacher or student who knows how and where to access it. These resources include the following:

- free education services, such as AOL@School, Microsoft and Apple education Web sites, that provide students with on line learning resources, activities and templates, and teachers with lesson and unit plans that support state and national curriculum standards
- Web-based reference services for students such as KidsConnect, Educator’s Reference Desk, and Mad Scientist Network
- links to public, university, and government library collections
- primary source information through access to experts across the globe in various professions and areas of expertise
- access to vast collections of still pictures and motion videos, animations, and digital presentations on diverse subjects
- virtual tours of museums and historical sites around the globe such as the Smithsonian, Louvre, National Gallery of Art, and Colonial Williamsburg
- live Web cams throughout the world that permit students to view the activity within the canopy of a rainforest, the world of a panda bear, or corn growing in our nation’s heartland
- online courses via distance learning services, businesses (e.g., Barnes & Nobles), and colleges/universities (many are offered for free while others include a subscription or enrollment fee)
- online learner productivity utilities including surveys, citation generators, and plagiarism checkers
- student research portals and tools including search engines
- Web quests and Web scavenger hunts are available for nearly every content area for all instructional levels
- online learning communities such as Tapped In at http://www.ti2.sri.com
- online tutors such as Think.com
4.0 LEARNING ENVIRONMENTS AND SCHOOL FACILITIES

The federal No Child Left Behind (NCLB) legislation requires that schools and districts across the nation invest their federal funds for student achievement on strategies that are scientifically proven best practices. Likewise, the legislation desires that school facilities, especially new construction, reflect current design standards for buildings that are safe, secure, and environmentally friendly. The following information presents current research and best practices for the topics covered in Chapter IV: Learning Environments and School Facilities. These topics include:

Included in the Technology Blueprint are a number of Major Recommendations. The purpose of this section is to provide a summary of the research and best practices information available to support the recommendations. The major recommendations related to Learning Environments and School Facilities are:

- LE&SF-1: Establish and Maintain Standard Classroom Configurations
- LE&SF-2: Expand Wireless Mobile Computer Environments
- LE&SF-3: Expand Video-Conferencing Capabilities of District
- LE&SF-4: Establish and Maintain Infrastructure Standards
- LE&SF-5: Continuously Update IT Prototype and Construction Specifications

In support of these recommendations, the following information presents current research and best practices for the topics covered in Chapter IV — Learning Environments and School Facilities. To facilitate navigation of the information in this section, the following is a table of contents for this section:

- Technology-enhanced Learning Environments
  - Classroom Technology Configurations
  - One-to-one Computing Strategies
  - Graduated Model for Integrated Computing
  - Hand-held Computers versus Laptop Computers
  - Overview of Underway Integrated Computing Initiatives
  - Laptop Initiatives
  - Other schools with ubiquitous computing initiatives
  - Hand-held Computers Initiatives
  - Classroom Computer Cluster
  - Computer Lab Environments
  - Instructional Technology Classroom or Computer Lab Functions
  - Thin Client Computer Labs
  - Laptop Computer Labs
In addition to nationally researched approaches, the current work of the M-DCPS and the state of Florida is reflected in this body of knowledge.
4.1 Technology-enhanced Learning Environments

The research and best practice information in the following section supports recommendation LE&SF-1: Establish and Maintain Standard Classroom Configurations

M-DCPS seeks to develop prototypes for best practice, scientifically researched learning environment modules to assist schools and teachers in developing multiple strategies for building environments that best support their curriculum approaches. Learning environments will be designed to support a range of instructional activities appropriate to meet the developmental needs of the learners, staff competencies, school improvement initiatives, and specific technology applications. These learning environments will include:

- teacher workstations with projection capability
- individual networked classroom computers with task-specific peripherals
- individual, portable computing devices for every child, such as text processors, PDAs, and graphing calculators for content-specific activities
- classroom computer clusters (two-to-five networked computers per classroom)
- mobile computer labs on recharging carts with wireless network connectivity (carts are available for fifteen-to-thirty laptop computers)
- instructional technology and vocational laboratories of twelve-to-thirty computer workstations
- information and technology resource centers with print and digital content and access to on-line subscription services
- distance/virtual learning centers
- school-level administration workstations

M-DCPS educators should match potential learning environment configurations to the types of learning or instructional activities that will take place in each setting. For example, schools that currently support a computer lab approach should reconsider the established configurations to determine if they provide effective cooperative learning environments. It is important that schools remain in control of local decision making regarding technology options that reflect the unique needs and goals of the school community and the existing learning environment. However, information resources or other support from district technical support in making decisions regarding wiring, Internet drops, computer locations, furniture, or other environmental issues should be readily available. School personnel will need to consider how to deploy appropriate resources (e.g., hardware, software, technology, support services) effectively in order to maximize the benefits of the entire technology system. The equitable distribution of the technology resources throughout the schools will enable all students, teachers, and administrators to function more effectively.
Accessibility and mobility of resources is critical. Teachers should be able to provide ideally one-to-one student to computing resource ratios as needed by requesting and reconfiguring existing technologies. These blended technologies learning environments may include desktop and laptop computers; numeric and graphing calculators; hand-held computing devices; portable word processing devices; peripherals such as color printers, scanners, digital and digital video cameras; and sufficient consumable resources to maximize the potential of these devices. The goal is for each classroom to have nearly on-demand access to these resources with minimal difficulty.

Figure 4-1: Blended Technologies Learning Environment Components diagrams the components that can be configured to create blended technologies learning environments. The information and technology resource center serves as the hub within the school for both print and digital media.

Technology-enhanced learning environments are usually, but not always, designed to incorporate one or more computers. The capacity, location, size, mobility, versatility, peripheral devices, and accompanying software applications all help to define the functional capacity and intent of specific learning environments. Most school environments will implement variations on one of six model configurations: classroom computer (generally teacher station), computer clusters (three-to-six computers), computer classrooms (fifteen-to-thirty
computers), individual computing devices (one-to-one device to child ratio), information and technology resource center technology resources, and distance learning classroom. An orientation to the potential of each model configuration is provided in this section.

These technology enhanced learning environments are intended to be dynamic models that encourage the creation of hybrids and variations to meet the specific needs of the students.

This section of the Blueprint will assist M-DCPS educators with the selection of realistic and appropriate technology learning environments to address district needs and priorities. Diagrams of each model/configuration follow the more general description/overview of its functions and their instructional links to help decision makers visualize the models and their potential uses.

### 4.1.1 Classroom Technology Configurations

The instructional technology configurations envisioned by M-DCPS leadership seek to allow the district to move from traditional learning environments to new learning environments as outlined in the table below.

<table>
<thead>
<tr>
<th>TRADITIONAL LEARNING ENVIRONMENTS</th>
<th>NEW LEARNING ENVIRONMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td>To</td>
</tr>
<tr>
<td>➢ Teacher-centered instruction</td>
<td>➢ Student-centered Instruction</td>
</tr>
<tr>
<td>➢ Single-sense stimulation</td>
<td>➢ Multi-sensory stimulation</td>
</tr>
<tr>
<td>➢ Single media</td>
<td>➢ Multimedia</td>
</tr>
<tr>
<td>➢ Isolated work</td>
<td>➢ Collaborative work</td>
</tr>
<tr>
<td>➢ Information delivery</td>
<td>➢ Information exchange</td>
</tr>
<tr>
<td>➢ Passive learning</td>
<td>➢ Active/Exploratory/Inquiry-based learning</td>
</tr>
<tr>
<td>➢ Factual, knowledge-based learning</td>
<td>➢ Critical thinking and informed decision making</td>
</tr>
<tr>
<td>➢ Reactive response</td>
<td>➢ Proactive/planned action</td>
</tr>
<tr>
<td>➢ Isolated, artificial context</td>
<td>➢ Authentic, real-world context</td>
</tr>
</tbody>
</table>

To achieve these new teaching and learning environments, a remodeled classroom is articulated that includes new teaching tools that will dramatically appeal to students’ eyes and ears.

- A digital device for each student
- A laptop computer for each teacher
- Overhead, ceiling-mounted multimedia projector
- Interactive white board
- Mounted speakers/sound amplification system
- Multiple media input options via a teacher’s control panel
- Campus-wide wireless network connectivity

In the classroom the single computer generally serves one of three primary roles:

- teacher presentation/management station (frequently off-limits to students)
- shared presentation/group activity station (projection capability a must)
- highly specialized, custom configuration for a specific task and/or audience

Presentation/Group Activity Station

This use of the computer has proven successful using one-computer-classroom software applications called “groupware,” such as those developed by Tom Snyder Productions. In this environment only one computer is needed to direct and store the work and activities of many groups of students. The ability to project an image of the computer screen to a large group, using either a stand-alone projection device, or a scan converter with a large screen television/monitor or a LCD projection panel and overhead projector. Software would include simulations, groupware programs, and presentation creation applications.

The presentation/group activity workstation is normally located in an area of the room where a small group of students can work together without disturbing the remainder of the class, but also where all students can view a projected image for large-group interactions. The intent is to allow the class sometimes to engage in a large group activity, using the computer as an information source, and at other times to let a small group of students use the workstation during the class session for a presentation/project.

The exact location needs to be determined on a room-by-room basis. Multiple data cables should be available at this location. Two-to-six data cables should be considered for this area. If there are definite plans to utilize video applications at these workstations, the district should consider providing a second video drop cable at the outlet. The cost impact of adding these video drops must be compared to their benefits.
Custom Computer Configurations

The computer (desktop or laptop) customized with peripherals and software is designed to address a specific purpose, activity, and/or task. The use of this computer may range from a highly specialized system equipped with adaptive/assistive devices for a specific physically and or educationally challenged student, that will travel with the child throughout the school day, to a desktop publishing system complete with scanner, laser printer, clip-art, and digitizing equipment that may be used by all teachers and students on a sign-up basis. In most school buildings, mobility is a key component of this design, allowing freedom of movement for the special-needs child and access to the special capabilities of these systems for teachers and students, as needed.

Optimally, these configurations will be network ready, providing access to printers, modems, and other network features. Software applications and peripherals selected for incorporation in these unique configurations will vary at the different instructional levels and according to the targeted function.
The basic computer unit serves as the foundation for building various configurations by incorporating specific software and peripheral components, each designed to provide unique functionality. The task of educators is to link this functionality effectively with curriculum and management needs and outcomes. Software selection will define the capacity of the system required in terms of memory, hard drive, and system speed for acceptable performance levels. A sampling of custom workstation models follows.

**Desktop Publishing**

In most every classroom a desktop publishing configuration complete with laser printer, scanner, digitizer, and accompanying software including layout and design programs with clip-art can enhance the quality of student generated projects from content specific reports, poetry, newsletters, advertisements, to the school yearbook. The professional look and the sense of a collaborative product develop camaraderie, pride, and confidence in students.

The desktop publishing configuration generally consists of a laser printer or color inkjet printer, scanner, and digital camera with appropriate software including layout and design programs and clip-art collections. A monitor large enough to display full-page portrait orientation and side-by-side pages is also a desired feature of this configuration.
Instructional Multimedia Presentation/Production

As schools prepare students to share information gathered in an interesting and engaging manner, the presentation/production configuration with both audio/video input and output capacity; a scanner; and CD-ROM, laserdisc, DVD, and video support will provide an engaging and interactive stage upon which they may choreograph their presentations. Multimedia/hypermedia programs at all levels provide for the integration of visuals, sound, text, and animation. The ability to project an image of the computer screen to a large group, using a stand-alone projection device is an important element of this configuration.

Music

With the incorporation of technology into the music curriculum, students can create new works and study existing pieces as never before possible. In combination with special composition software, a MIDI keyboard connected to the computer allows students to create spontaneously while the computer records and remembers the details. As with words and a word processor, students may then review their musical composition, revise, and edit as desired. The student may begin the score today in an upbeat and happy mood and finish the piece tomorrow in a somber or melancholy mood, with the information saved to floppy disk, hard drive, or network storage between intervals. CD-ROM writers allow student compositions to be saved to CD in the same medium of popular music stars. Music CD-ROM discs combining music and graphics allow students to study the music of diverse cultures from all over the world.

Arts

For the student who never felt like an artist, the use of technology in the arts provides a pathway toward creativity through graphic programs that encourage exploration of shapes, colors, patterning, repetition, and recursion. The low cost of color printers adds another dimension to this level of exploration. Specialty software programs allow for cartooning, technical drawing, and combining colors and sounds. Laser video and DVD resources provide the teacher of fine arts with a venue, allowing students to explore the characteristics and trends of individual artists or time periods.

Video Production

The configuration of video production enables students to record, edit, and create nearly commercial-quality video segments. These might result in student-generated commercials, MTV-like music videos, documentaries, and/or short movies. With the addition of video production software to a high-end (significant RAM and hard drive capacity is required) workstation, students are able to input digital video
from camcorders, VCRs, DVD, and/or laserdisc players and output edited and compiled video onto an external monitor/TV for review, critique, and revision.

**Physical Education**

Students are instructed that physical education and exercise is good for their health and well-being, but these concepts are often difficult to prove within the classroom. Bio-feedback probes and devices connected to a computer allow educators to demonstrate reduced/increased heart rates and stress control, and record subtle changes over time. Real-time data gathered during these activities in the physical education environment can be evaluated in science and math classes, as an interdisciplinary link. Digitized videos of gymnastic moves, football throws, and golf and tennis swings allow students to compare, contrast, and critique their form with that of their peers.

**Career and Technology Education**

In an effort to keep abreast of changes dictated by the demands of the 21st century, career and technology education, as the combination of many business educational and vocational educational programs have been renamed, has seen an enormous influx of vocation-specific applications and peripherals. In an effort to replicate the technologies found in today's business community, many secondary schools incorporate sophisticated office automation and business systems into the curriculum, frequently providing a host of services to the community. The "auto shop" incorporates specialized programs and computer systems for diagnosing and repairing vehicles. Drafting and engineering programs have embraced many facets of computer-aided design (CAD), followed by computer-aided manufacturing (CAM) in woodworking and metals. In the technology-enhanced "machine shop," students use computer equipment to design and program.

**4.1.2 One-to-one Computing Strategies**

Miami-Dade Public School District seeks to explore implementation approaches that allow students ubiquitous access to computing resources for teaching and learning. These approaches have been evolving across the nation under a number of different names such as Anywhere, Anytime Learning; One-to-One Computing; Laptop Learning; and 24/7 Access. Inasmuch as the names differ, so do the approaches to achieving ubiquitous computing, ranging from the early learner to the high school student. The purchasing, funding, dissemination strategies differ as do the computing devices, software alternatives, and network access.

Over the past ten years this evolution has grown from small, independent school efforts to statewide initiatives. District leadership seeks to identify those implementations most like the district in terms of magnitude and
vision. Currently the largest laptop computing initiatives include the state of Maine (36,000 laptops deployed to 7th and 8th grade students and teachers) and Henrico County in Virginia (26,000 laptops deployed to middle and high school students). Miami-Dade’s neighboring district, Broward County, announced in July 2005 that it will be purchasing 30,000 iBooks for use by students in grades 1-12.

Reported in the New York Post, New York City Board of Education announced on July 21st, 2005 that hundreds of sixth-graders will receive free wireless laptop computers at the start of the school year that they will be able to take home. The city Department of Education will give out laptops to sixth-graders at 22 schools across the five boroughs. The plan also includes converting all of its computer labs to wireless over the next five years. More than 800 of the NYC’s 1,100 schools are already configured with wireless access connections.

The state of Michigan’s Freedom to Learn (FTL) initiative has provided access to wireless laptops to approximately 20,000 middle school students and 1,200 teachers from 188 schools in 95 districts across the state. Marked improvements in Michigan Education Assessment Program (MEAP) standardized test scores in reading, math, and science hopefully will provide the incentive needed for Governor Granholm to reinstate the program’s funding. As of August 2005, the $3.7 million for the initiative had been cut from the budget to help address a significant state shortfall of education funds. More information about the FTL program can be found at www.ftlwireless.org.

Before exploring the host of computing devices available in the educational marketplace, it is important to define the differing one-to-one environments that can be created. All of these options may meet the various needs of M-DCPS for differing learning audiences:

- **Classroom on-demand access** – this model describes the environment in which the classroom teacher can create a one-to-one ratio of learning devices to students within their classroom (or a cluster of classrooms) with little difficulty. These devices are used from class to class; and although the same device might be consistently assigned to specific students for tracking purposes, the students do not generally keep the device with them. The device might be any one of those described in greater detail below, from a graphing calculator to a laptop computer.

- **One-to-one access within the school environment** – this model describes the strategy by means of which students are assigned a learning device that they keep with them throughout the school day. Students in middle and high school levels take the device with them from class to class, using it for projects, note taking,
scheduling, research, and content specific activities. At the end of the day, the devices are returned to a central, secured location for recharging overnight. In this model the learning devices generally do not leave the district facilities.

- **One-to-one access 24/7** – this model describes the strategy by which students are assigned a learning device that they keep with them throughout the school year and are allowed to take home regularly, if not every day.

This section presents the various devices and strategies available for in-depth investigation by M-DCPS leadership. These include learning devices for developmentally different age groups, distribution approaches, and networking strategies. Providing a device per child by purchasing classroom sets of these individual computing devices has proven effective and even affordable. Two different strategies are available: (1) less than fully functional computing devices that complement desktop workstations selling for approximately $300; and, (2) fully featured portable laptop computers that are Internet ready, some using wireless technology to connect.

It should also be noted that the Florida legislature commissioned a study in October 2003 to "assess the use of mobile laptop computers in all learning environments as it relates to student success in grades K-12."

The final report was released in March of 2004 and is entitled *Laptops for Learning: Final Report and Recommendations for the Laptops for Learning Task Force*. This report can be found at the following Web address: http://etc.usf.edu/. The legislature has yet to respond publicly with future actions or commitment of funds to support the recommendations included in the report.

The recommendations of the Task Force report have been carefully considered in the development of this section of the *Information Technology Blueprint*. It is noteworthy that the report recommends only the adoption of fully featured laptop computers. The variety of available computing devices and configurations are detailed in the following sections.

**Hand-held Learning Aids/Devices**

Designed originally for the home market, hand-held devices are targeted for the primary learner. Providing activities in early literacy concepts in reading, mathematics, and English, these engaging devices present information using a multi-sensory, interactive approach that combines seeing, touching, and hearing. Perhaps the most popular of these devices is the Leapfrog collection of learning aids. Broward County has invested in a significant quantity of the Leapfrog devices and activities for...
a summer school initiative. It has been experimenting with classroom sets of these learning devices for on-demand, one-to-one learning in primary classrooms. These devices are not generally assigned to individual students or sent home for use beyond the school environment.

**Hand-held Computers**

Originally called personal digital assistants (PDAs) and used primarily as an electronic address book and calendar, these devices have now earned the label of hand-held computers. Available in multiple operating systems, they are compatible with current productivity suites, can be used to send and receive e-mail, connect to full-size keyboards for data entry, and communicate with wireless networks to browse the Web. Under the direction of Dr. Elliot Soloway at the University of Michigan, a number of education-specific applications have been designed for hand-held computers, including, Pico Map, Cooty, FreeWrite, and Sketchy. Major software developers, including the very popular Inspiration, are now porting over some of their best selling titles to hand-held operating systems. Many school districts are exploring the use of hand-held computers with portable keyboard configurations as a low-cost alternative to providing laptop computers to achieve ubiquitous computing.

**Portable Writing Devices**

Introduced to provide a low-cost alternative to create classroom writing laboratories, battery operated, portable writing devices have been available for over ten years. These devices include the AlphaSmart and Neo (Intelligent Peripherals). Designed to withstand the rigors of elementary age students and encourage students in the writing process of brainstorming, drafting, reviewing, editing, and revising, they significantly expand the potential of a cluster of desktop computers. Classroom sets of these portable writing devices provide one-to-one access for students to begin the writing process. Files are then transferred, via cable or infrared signal, to any application open on the workstation (word processor, presentation application, and spreadsheet) for manipulation, publication, and/or printing or posting. Portable writing devices purchased in the 1990’s are still in use today as there is no operating system to become obsolete. At most, districts needed to purchase new cables that connect via the USB port in place of the original serial port or the ADB as classroom computers were refreshed. Most of the portable writing devices run on regular or rechargeable AA batteries, lasting well over eight hours on one charge and months on standard batteries.

The features may vary, but both have a full-size keyboard, memory to store multiple files, a screen to view files, and the ability to share information either via cable or infrared with other like devices, computers, and printers. They are portable, durable, battery-operated, and intended to complement computer and printer resources. Some can be purchased
in sets with mobile, recharging carts that include a printer, thus creating a lab-to-go. With most of these devices selling for less than $300 per unit, the cost of twenty-five units, two computers, and two printers can cost less than 30% of the cost of a twenty-five-station computer lab also with two printers; yet each unit potentially may provide nearly 90% of the functionality in a writing classroom.

Released in 2002, the Dana by AlphaSmart, is a hybrid device. It looks like a portable writing device but runs on the Palm OS operating system. Thus it provides a robust design, full-size keyboard, with access to all the applications that have been developed for the Palm hand-held computer. Software developers have also refined their Palm products to take advantage of the screen that is three times larger than the standard screen on a hand-held computer. This device presents another promising alternative to laptop computers to provide on-demand, one-to-one learning.

**Graphing Calculators**

Software and peripherals available for graphing calculators and hand-held computers are quickly blurring the line between these two learning devices. Mathematical graphing applications allow the hand-held computer to graph complex mathematical equations that once could be done only on a graphing calculator. Portable keyboards and word processing software turn today’s graphing calculator into a writing tool. Probes, sensors, and meters are available to capture real-time analog data and convert them into digital input for graphing and manipulating. For students focusing in the areas of math and science, this once single-purpose device has now become a viable alternative for providing a low-cost, one-to-one learning solution.

In the areas of mathematics and science, the use of numeric calculators, graphing calculators, and CBLs (computer-based labs) using different probes and meters for real-world data collection, places the student firmly in the role of mathematician, scientist, and explorer of his/her world.

Graphing calculators support algebra, trigonometry, and calculus studies, allowing the student to manipulate and understand otherwise abstract and hard-to-grasp equations and relationships. CBL meters and probes linked to either a graphing calculator or computer, transform the world of analog information into digital data that can be graphed, charted, manipulated, and studied.

**Laptop Computers**

The first “Anytime, Anywhere Learning” initiatives deployed Windows-based laptop computers to students and teachers as a personal learning and management device through partnerships initiated by Microsoft. The Maine and Henrico County one-to-one initiatives deployed iBooks to target audiences within their respective environments. Both platforms
have demonstrated similar outcomes although there is still ongoing research regarding the impact of these initiatives on student academic achievement. Quantifiable data immediately available from the state of Maine show a significant increase in student attendance and decrease in discipline problems in the grades where the laptops are deployed.

The dream of a computer for every child became a reality in a number of K-12 schools across the nation in the late 1990's and the impact seen to date on teaching and learning is favorable. One of the earliest studies was published in June of 1997, Report of a Laptop Program Pilot: A Project for Anytime Anywhere Learning by Microsoft Corporation and Notebooks for Schools by Toshiba America Information Systems. This report presents the compelling evidence of the benefits and potential made possible through the "computer-for-every-child" strategy. Some of the benefits described in the Rockman report include on-demand access to technology at school and home, increased motivation by students and parents, active parent participation, and enthusiastic teacher commitment to the laptop initiatives.22

As fully-featured and custom-configured laptop computers become smaller and less expensive to purchase, upgrade, secure, and service/maintain, they become a more realistic strategy for integration into K-12 school environments.

Figure 4-4: Fully Featured Laptops with Wireless Network Access for Student Use

4.1.3 Graduated Model for Integrated Computing

Miami-Dade leadership may seek to consult with instructional technology leaders in Broward County who have been piloting and/or field testing a variety of devices, from the LeapPad learning systems to laptop computers in schools across the district. The primary goal of these activities is to determine the best graduated model for introducing learning devices into the different instructional levels within their district.

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The computing devices, applications, and integration strategies employed at the unique instructional levels (primary: preK-2, elementary: grades 3-5, middle school: grades 6-8, and high school: grades 9-12) are likely to be unique to each learning community. The Florida School Technology and Readiness (StaR Chart) can be used to determine schools that are best suited for pilots and/or field testing these devices. The StaR chart assesses readiness using rubrics in the following areas:

- **Technology Administration and Support:**
  - Technology Planning
  - Technical Support
  - Instructional Technology Support
  - School Budget
  - Funding

- **Technology Capacity**
  - Student Computer Access
  - Teacher Computer Access
  - Internet Access
  - Video Capacity
  - LAN/WAN
  - Curriculum-based Tools

- **Educator Competency and Professional Development**
  - Educator Use of Technology
  - School Administrators
  - Professional Development Budget
  - Models of Professional Development
  - Content of Professional Development

- **Learners and Learning**
  - Student Use of Technology
  - 21st Century Classroom
  - Secondary Technology Courses
  - Community Outreach

- **Accountability**
  - Student Technology Standards
  - Teacher Technology Standards

The Florida StaR chart can be found at [http://etc.usf.edu/L4L/D-STaR.html](http://etc.usf.edu/L4L/D-STaR.html).

LeapPad learning systems and accompanying activities are appropriate for use with primary learners. Portable word processing devices such as
AlphaSmarts and/or DreamWriters or the more fully functioned Dana could be field tested with elementary learners for enhancing writing skills across all curriculum areas. Hand-held computers and graphing calculators with portable keyboards have shown promise nationally at the middle and high school levels and generally carry a lower cost for initial investment, support, and training. M-DCPS may seek to field test both hand-held computers and laptop computers at both the middle school and high school levels to assess the differences, impact, and cost of ownership. A graduated model will allow for students to develop a comfort level and sense of responsibility for their learning device from their earliest school years.

The pilot and/or field tests will be conducted with a predetermined set of criteria for outcomes and expectations. In addition to improved student achievement, factors such as attendance, disciplinary issues, increased motivation levels, and greater student involvement in the learning process will be factored into assessment criteria.

Not only should the outcomes of each pilot or field test be analyzed for return on investment, but also the impact of the effort will be assessed in terms of impact in the network performance (bandwidth), technical support staff, and time required for staff development for teachers. All of these factors will be used to assess the potential for broad-scale implementation of a ubiquitous computing initiative.

In an effort to develop a projected budget that represents the attainment of ubiquitous computing over a five-year period, a proposed implementation schedule is included in Appendix C of this document and also in Chapter XIV. Budget, Funding, and Cost Savings.

4.1.4 Hand-held Computers versus Laptop Computers

Education is just beginning to amass a collection of scientifically-based research in the area of ubiquitous computing and the impact on learning. Studies are being conducted on the similarities and differences between the integration of hand-held computers and laptop computers. Both efforts appear to garner positive feedback from students and teachers, increase in attendance for participating students, decrease in discipline issues in participating schools, more engaged learning, and increased access to and integration of resources beyond the classroom walls. Educators still await scientifically-based evidence that test scores will increase significantly more for laptop learners than for students in similar learning environments but without ubiquitous access to a hand-held computer or laptop computer. The February 2004, *The Impact of Maine’s One-to-One Laptop Program on Middle School Teachers and Students: Phase One Summary Evidence Research Report #1*\(^{23}\) states that there is
already substantial self-reported evidence that student learning has increased and improved. It is likely to be at least one more testing cycle in the state of Maine before scientific analysis of the impact of its laptop initiative on student test scores can occur. Schools and districts moving forward with ubiquitous computing strategies are basing their decisions on the positive outcomes that have been observed and documented to date.

To date the primary advantages of hand-held computers over laptop computers are the reduced cost (devices and applications), size/portability, ease of use, battery/charge duration, and reduced obsolescence. Hand-held computers appropriate for student use in schools can be purchased with either the Palm or Window operating systems for less than $200. Connected or infrared portable keyboards are available for less than $100. These hand-held computers are generally loaded with a word processing application compatible with major word processing software at a minimum while others come with spreadsheet and presentation applications as well.

Low-cost software, developed exclusively for education by the University of Michigan HiCE group is distributed through the GoKnow Web site making the entry level per student cost for a hand-held computer approximately $300. The size of the hand-held computer and portable keyboards are also appealing to students and teachers, fitting easily in a pocket or purse. The icon-driven operating systems have proven easy to navigate, and the learning curve for use has been relatively quick for students and teachers. Most hand-held computers will hold their charge for a full day, thus eliminating the need to recharge intermittently during the school day. Operating system compatibility issues are lessened with the hand-held computers for both available platforms with respect to the device and the applications. Incompatibility issues that arise on laptops tend to be less of an issue (financial, logistical, and support) on the hand-held computers. As these devices become more sophisticated, this factor may change to be more like the operating system issues faced with laptop computers.

Despite the advantages noted for hand-held computers, some schools and districts prefer to invest in fully functional laptop computers for students in middle and high schools. The large-section purchases by the states of Maine and Michigan and Henrico County have been able to reduce the entry cost of these laptops to under $500 with a standard suite of software applications for learning. The increased screen size, capacity for processing still and motion video, and greater functionality provided when accessing information from the Internet appear to be some of the most significant factors for selecting the laptop solution. To date the repair/damage rates to the iBooks in Maine have been insignificant, and the devices appear to withstand well the rigors of daily student use and transport to and from home.

4.1.5 **Overview of Underway Integrated Computing Initiatives**

This section of the Blueprint provides summaries of current ubiquitous computing initiatives for investigation by M-DCPS instructional leadership. As noted earlier, the largest initiatives using laptop computers that are currently generating data for analysis are the state of Maine and Henrico County. For a brief history of ubiquitous computing visit, see: http://www.ubiqcomputing.org/Overview.pdf.

The following are summaries of integrated computing initiatives provided by the companies that are implementing them. These programs are underway across the United States using Macintosh and Windows laptops, and Palm hand-held devices.

4.1.6 **Laptop Initiatives**

**Starting Small, Thinking Big** – After nearly two full years of planning and a semester-long pilot program, the Manatee County Schools district is ramping up its one-to-one laptop initiative. By the fall of 2003, iBook computers running Mac OS X had been distributed in twenty-two elementary and secondary classrooms. [www.apple.com/education/k12](http://www.apple.com/education/k12)

**Rural School, Progressive Attitudes in Iowa** – In Iowa’s rural Carroll Community School District, all seventh graders and their teachers now have one-to-one computer access. In October of 2003 the district’s school board approved the acquisition of 135 iBook laptops, as well as Apple Professional Development for the faculty. [www.apple.com/education/k12](http://www.apple.com/education/k12)

**Divine Inspiration in California** – Located in the high-tech community of Santa Clara, California, Saint Lawrence Academy serves 350 students in grades 9 through 12. Late in 2002, the faculty decided to bring in technology as a core part of the curriculum for all students. After installing an AirPort wireless network, Saint Lawrence’s administrators distributed wireless iBook laptops to all students at the beginning of 2003 (all faculty and staff members had received their computers and training earlier in the school year). [www.apple.com/education/k12](http://www.apple.com/education/k12)

**Freedom to Learn With iBooks in Detroit** – After a year as one of the first pilot schools to implement Michigan’s Freedom to Learn program, in which iBook laptop computers were distributed to all sixth grade students, Malcolm X students have made dramatic improvements in their learning. [www.apple.com/education/k12](http://www.apple.com/education/k12)

**Transforming Kids with Technology** – The technical support team at B. F. Yancey Elementary in Esmont, Virginia, takes care of the usual assortment of tasks. They load printer drivers, transport the school’s
wireless iBook systems in and out of classrooms, tutor students in the use of their software applications, organize Web sites for teachers, and show parents how to make computer-based presentations.

www.apple.com/education/k12

**Teens Corner Technology** – To the casual observer, it is not an unusual scene. A group of inner-city teens meets up on the street corner. Laughing and joking, no one seems to be in a hurry to head home. But upon closer examination, the gathering is far from the ordinary. These high school students are clustered around a wireless iBook computer, watching one of their own surfing the Web for a research project. And the corner is in Long Beach, California, where participants in the CORAL Youth Institute are learning the technology and leadership skills that will empower them to make their neighborhoods a better place to live.

www.apple.com/education/k12

**Wireless iBooks Expand Learning, Shrink Technology Budgets** – After distributing 350 iBook computers with AirPort Wireless Cards to every Petrides High School student the previous fall, the school expanded the program into its middle school classes, using the theme Leap into the New Millennium with the iBook. Now, over 850 wireless iBook computers are in use at Petrides, significantly reducing the school's technology costs while increasing student access to computer-based learning at school and home.

www.apple.com/education/k12

**iBook Laptop Initiative Raises Student Achievement** – Thanks to the implementation of a new wireless iBook laptop initiative, nearly 80 percent of all graduating seniors at Cascade High School are now planning to earn college degrees and student achievement is on the rise. Even in an area where few parents can afford computers or Internet access, CHS students now have educational opportunities available to them beyond the classroom.

www.apple.com/education/k12

**Wireless iBooks Help Students Teach the Parents** – One night a week, the area's adults are going back to school... and their children, armed with iBooks equipped with AirPort Wireless Cards, have become their teachers. It's all part of a Learn and Serve Grant from the Virginia Department of Education, called Bringing Students and Communities Together.

www.apple.com/education/k12

**Microsoft To Help Design $46m High-tech High School** – Extending its reach in public education, Microsoft Corporation says it will help design a new $46 million public high school in Philadelphia that will embed computer technology everywhere-from classrooms and administrative offices to the desk of the football coach.


**Laptop Lessons: Exploring the Promise of One-to-One Computing** – When Maine Governor Angus King recently proposed using the state's $50 million surplus to outfit every seventh- and eighth-grade student and teacher in the state with a laptop computer, the phrase "laptop learning"
became headline news across the nation. And when the New York City Board of Education approved a plan to provide the city's fourth-grade students and teachers with notebook computers next year—and eventually deploy some 850,000 portable devices to all students, teachers, and administrators in the system—it confirmed that laptop programs have indeed become a full-fledged movement.

http://www.techlearning.com/db_area/archives/TL/200105/laptops.html

**Tablet Computing: The Next Big Thing in School Computing Has Arrived** – Bishop Hartley High School is about to make history. This fall, the 600-student private Catholic school in Columbus, Ohio, will put to the test the Tablet PC—the new technology that Microsoft chairman Bill Gates recently called "the future of one-to-one computing."

http://www.eschoolnews.com/resources/reports/TabletSpec403/index.cfm

**“Laptops Change Curriculum-and Students”** – Article by Sharon Cromwell, Education World® At one Bloomfield, Connecticut, middle school, all the students have laptops, and life is going smoothly, thanks in part due to a large dose of teacher preparation.

http://www.education-world.com/a_curr/curr178.shtml

**Laptop Computers for Every Student!** – Beside every eighth grader's seat at Kent Center School sits a padded backpack with a laptop computer-provided and paid for by the school! Students completing their last two years at this K-8 school in rural Connecticut are also the keepers of Toshiba laptop computers. Education World®

http://www.education-world.com/a_curriculum048.shtml

All the above need a heading indicating that they've been lifted from somewhere as evidence in favor of CELT's plan. They seem to go on forever.

### 4.1.7 Other schools with ubiquitous computing initiatives

**Athens Academy** is a coeducational, independent, college preparatory day school. Its Media and Technology page provides information related to the technology initiatives of the Academy and its partners.

**Brewster Academy** is an international college preparatory school, recognized for its success in using information technologies to accelerate student growth. Brewster Academy has chosen the Apple PowerBook and iBooks as its basic machines and have succeeded in the most ambitious possible goal: a computer for every student, wherever they go and whatever they are doing at Brewster Academy.

**Cincinnati Country Day School** is a K-12 private school where every child in the 5th grade and above has a laptop, connecting him/her to a world of information on the Internet, to homework assignments posted on the Net, to teachers and peers via e-mail.
Detroit Country Day School is an independent, coeducational, non-denominational, college preparatory school for pre-kindergarten through Grade 12 students. Consequently, every student and teacher from the 6th grade forward is equipped with a laptop computer.

“Loogootee School District Puts Thin Client to Innovative Use,” an article by Bob Butcher, TechLEARNING, December 1, 2001. Loogootee, Indiana, transformed its outdated career center by taking advantage of a National Semiconductor Thin-Client @ School Award. [http://sswug.com/see/7070](http://sswug.com/see/7070)

Beaufort County, South Carolina “Laptop Computers and Their Impact on Sixth-Grade Learning,” by Ken Stevenson, The Technology Source, March 1999. The Beaufort County School District provided 300 6th graders with their own laptop computers. The results after only one year was 66% improvement in spelling skills, 60% in writing skills, happy parents, and happier teachers! [http://technologysource.org/article/laptop_computers_and_their_impact_on_sixthgrade_learning/](http://technologysource.org/article/laptop_computers_and_their_impact_on_sixthgrade_learning/)

### 4.1.8 Hand-held Computers Initiatives

The following examples of hand-held computing initiatives and more can be found at the PalmOne Web site, [www.palmone.com/us/education/studies/#k12](http://www.palmone.com/us/education/studies/#k12)

Clark County School District–Even in a large school district, it can be individual staff members who move ideas and innovations forward. Charles Sinicki, the educational computing strategist at Bob Miller Middle School in Clark County, NV, took it upon himself to make Palm hand-held usage a reality at his school. His goal was to find a way to use hand-held devices for every classroom application possible, from reading to writing, to arithmetic and science, to social studies and beyond.

Manatee High School & Sea Breeze Elementary School – Instructional Technology Specialist Nan Sisemore helped write a successful grant two years ago that merged nature and hand-held technology and created an unusual collaboration between the Manatee County’s youngest and oldest students. It seems only natural that marine science should be important in this county that encompasses Bradenton, Florida, and its surrounding areas on the state’s west coast. The abundance of ocean and waterways has a big impact on all manner of life here. It also serves as a convenient and unrivaled laboratory for the county’s schools.

### 4.1.9 Classroom Computer Cluster

The purpose of placing computers in classrooms is to improve the teaching and learning process while simultaneously addressing the equitable distribution of technology resources for all students. With
multiple computers in classrooms, labs, and libraries, students can regularly use computers and software to enhance their learning in conjunction with their daily course work. Computers placed in classrooms can be arranged according to the teaching styles appropriate to each grade level and subject area. Configurations that best support the specific needs of each learning community (i.e., special program, specific discipline) must be considered.

Computers should be moved from labs to classrooms as much as possible, preserving labs when appropriate to learning needs. Existing technology should be replaced or refreshed when it no longer enhances the teaching and learning processes in classrooms or labs. A district-wide purchasing schedule for new computers focuses on providing an equitable distribution base of these resources.

**Basic Computer Unit**—The basic computer unit—whether desktop, laptop, hand-held, or thin client—serves as the foundation for building various models by incorporating specific software and peripheral components, each designed to provide unique functionality. The task of educators is to link this functionality effectively with curriculum and with instructional management needs and outcomes. Software selection and other factors will define the capacity of the system required in terms of memory, hard drive, and system speed for acceptable performance levels; and these will vary over time. A projection device for each classroom significantly enhances the potential of the classroom computing.

**Classroom Computer Cluster**—The classroom computer cluster presents a flexible learning environment, especially when classroom sets of individual computing devices such as word processing devices (AlphaSmart/dana), graphing calculators, and hand-held computers are available on-demand for teachers to provide one-to-one computing ratios. These devices can share information between like devices and with computers using either infrared or wired options.

**Instructional Technology Cluster**—The instructional technology cluster consists of approximately three to six networked computer systems grouped in same instructional area. These systems may remain in one location for the duration of the school year, a semester, or the duration of a special project. School-wide network connectivity of these systems will provide access to printers, Internet access (modems), CD-ROM towers, library media center resources, and DVD/laserdisc players. The ability to project an image of the computer screen using either a multimedia projector (best approach), a scan converter with a large screen television/monitor, or a LCD projection panel and overhead projector significantly increases the large group impact of the cluster.

The instructional technology cluster allows for potentially 30%-to-60% of a class to work independently or in small groups on instructional activities. Functionally, the instructional technology cluster lends itself to a wider range of small group and cooperative learning experiences. In addition,
the facilitator may wish to incorporate presentation capabilities by projecting computer-generated lessons onto a large screen with the use of projection device. Rather than assume that all students will be working simultaneously on a computer-assisted instructional task, this organizational pattern incorporates as its core the computer-as-resource, and computer-as-tool philosophy. The implication is that technology would serve as a supplement to and vehicle for instructional delivery and/or student production.

**Within the Regular Classroom**

Within the regular classroom, a technology cluster encourages the use of computers as a learning tool. Specific software programs, including drill and practice, tutorial, and simulations, would be used to introduce, review, and/or remediate content-related information. Extensive use of word processing at all grade levels, databases from the upper elementary grades through high school, and spreadsheets from middle school through high school would allow for the integration of information from one discipline to another across the school network, from class to class.

**In Specialist Clusters**

Specialist clusters located throughout the school for keyboarding, art, music, special education, or other specific purposes may be found within classrooms, in the information and technology resource center, and/or student tutoring/support centers.

As teachers more fully incorporate and integrate technology into all aspects of their teaching style, specialist areas (art, music, physical education, vocational/technology education, special education), will demand additional technology resources. Teachers who were once satisfied with a single custom computer configuration, will require a specialist cluster of systems to achieve their instructional goals. Software and peripherals will be unique to the discipline being covered (see the custom computer configurations described above).
The instructional technology cluster is an ideal complement to some of the individual computing devices described earlier. Classroom sets of these low-cost devices, used in conjunction with a cluster of desktop workstations can mirror the functionality of a full-scale computer classroom/lab for a fraction of the cost.

4.1.10 Computer Lab Environments

The Instructional Technology Classroom, or Computer Lab, provides a one-to-one student-to-computer ratio by locating approximately fifteen-to-thirty networked computers in one instructional area. Specific functions of these classrooms may require access to one or more file servers. School-wide network connectivity of these systems will provide access to printers, Internet/WWW access, networked CD-ROM resources, library media center resources, and DVD/laserdisc players. The ability to project an image of the computer screen to a large group using a projection device significantly increases the quality of large group instruction. A permanent, ceiling-mounted projection device is generally the preferred projection solution in this environment. The inclusion of an "electronic white board" for efficiently capturing and downloading brainstormed ideas, diagrams, charts, and other board notes is recommended.
Although the size and shape of specific instructional areas may dictate the layout of the instructional technology classroom, four of the most common layout options are:

- multiple corner clusters (see Figure 4-6)
- multiple hexagon clusters
- around the perimeter stations (work tables in center)
- rectangular back-to-back stations

Specialty areas in M-DCPS schools may include one or more computer labs with approximately thirty computers and/or an information and technology resource center with fifteen-to-thirty computers for student and teacher use. Computer labs are now available in both stationary (generally desktop systems) and mobile varieties (comprised of laptops and a printer in a recharging cart with wheels). Stationary computer labs are hardwired to the network and generally provide the wide bandwidth required for accessing and distributing video. Mobile labs use wireless technology to connect to the network and are well-suited to accessing the Web, sharing files, and connecting to printers, but generally do not have the bandwidth to support high volumes of video media.
Traditionally referred to as the “computer lab,” this physical layout enables students to work individually or in pairs at a variety of technology-based projects. When students engage in thematic and interdisciplinary units, it is possible to expect that different groups of students may work on several aspects or assignments simultaneously, depending on student need and software availability. Thus the primary function of this particular format becomes one of individual, small group, or team production area.

Regardless of the floor plan selected for the instructional technology classroom, the function(s) identified will determine hardware, software, peripherals, scheduling, professional development, and staffing needs. This model generally provides for a one-to-one or two-to-one student-to-computer ratio. Depending upon student population, number of computers in the classroom, and proficiency levels of teaching staff, the instructional technology classroom can address one or a combination of the following:

4.1.11 Instructional Technology Classroom or Computer Lab Functions

Writing Laboratory

Focused on experiencing the writing process of brainstorming, list generating, writing, critiquing, and revising the writing lab is directly connected to the language arts curriculum with class time scheduled and managed by the language arts teacher(s). Ideally, written work generated in a writing lab can be accessed from other workstations throughout the school facility.

Instructional Integration Activities

Available to classroom teachers for conducting specific technology related activities requiring a high student to computer ratio, this instructional technology classroom model would be available on a sign-up basis. Systems must be in place to ensure that required applications, peripherals, and support services are available to assist classroom teachers with these integration activities.

CAD/CAM and Engineering Courses

Generally found at the secondary level, the Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) lab enables students to experience and develop production skills comparable to real-world industry. Students work independently or in pairs with instructors trained on these very specific software applications and accompanying peripheral devices. Engineering programs, such as Project Lead the Way (PLTW) require high-end workstations to support the engineering applications used in industry.
Business Applications Center

Students experience the world of office automation and the corporate environment in this business application model with state of the art hardware and software applications. Mastery of sophisticated word processing, database, spreadsheet, and presentation applications, along with the interchange of information from one application to the other is a focus of this environment. The fluent use of e-mail, messaging, scheduling, and conferencing applications is also emphasized.

Personal Productivity Centers

Personal productivity centers for teachers and/or students (either separately or in a shared facility) provide computers for completing assignments, grades, correspondence, projects, and/or course work; network access allows for retrieval of data files from previous classes from networked servers.

Computer Literacy/Programming/Computer Science

Computer literacy labs are generally staffed by a full- or part-time technology instructor(s). Computer literacy classes include introduction to computer vocabulary and terminology, identification of computer parts and peripherals, history of computers, introductory programming concepts as well as introduction to word processing, databases, spreadsheets, and graphics programs. Although the current trend is to integrate more and more of this information and skill sets into the core curriculum, classroom teachers still require support with developing, aligning, and delivering this curriculum content.

Programming and computer science courses are usually taught by classroom teacher(s) and/or programming teacher(s). These courses range from introductory programming concepts with a "turtle" based programming language at the elementary level to sophisticated languages such as Visual Basic, C and C++, Java at the high school level. HTML programming for development of Web-based instruction, activities, and products is currently in great demand both within schools and the business community.

Integrated Learning Systems

Specially designed to deliver, manage, and assess selected instructional objectives, an ILS generally requires a one-to-one student-to-computer ratio and staffing to manage the flow of students on the system. Once comprised mainly of proprietary applications, current ILS collections include and integrate many popular software applications into their management systems.
4.1.12 Thin Client Computer Labs

With the increase in bandwidth, high-speed network capacity, and the multitude of Web-based applications, the use of thin client technology, such as Citrix, has again appeared on the horizon as an alternative in networked learning environments. With school and district-based servers providing access to productivity applications and browser software servicing student Internet needs, older computers with insufficient capacity to function as modern workstations and specifically designed thin client devices are able to provide a significant percent of instructional computing needs.

This strategy would prove effective for Writing Laboratories, Integrated Learning Systems, Personal Productivity Centers (for students and the community), and Business Applications courses. Applications less well suited to the thin client environment include those that require specialized applications (CAD/CAM), video production, or the addition of specific peripherals for data transmission.

4.1.13 Laptop Computer Labs

In an effort to address space constraints with respect to both room size and available surface area for computing devices, schools are creating computer lab environments with laptop/tablet computers. Whether connected via wired or wireless network solutions, the laptops require less surface area and can be completely stored away in lockable cabinets to recharge during times when they are not required, and to ensure physical security for the devices. Additionally, these lockable cabinets often are placed on casters such that the entire cabinet/lab, usually including a wireless router, can be moved from one classroom to another with ease. This strategy provides on-demand computing power while maximizing and securing district resources.

The primary drawback to this strategy is the additional cost incurred at time of purchase. With equivalent desktop versus laptop computers, the laptops are generally more expensive in both short and long range to upgrade or refresh. When mobility needs and space constraints prevail, this is still a very popular strategy for providing on-demand access to computing devices. Initially the smaller display size was also a factor to be considered when choosing between desktop and laptop devices, but the laptops have improved significantly in this regard over the past few years.

4.1.14 Blended Technologies

Blended technologies learning environments are flexible configurations of existing technology resources within a school environment. The components are designed to support a range of instructional activities
appropriate to the developmental needs of the learners, staff competencies, education reform initiatives, and specific technology applications.

Concepts, Components, and Models

Prototypes of blended technologies learning environments can also be configured that provide on-demand, one-to-one computing access that is cost effective and maximizes the potential of existing resources. These prototypes are differentiated by instructional level (primary, elementary, middle, and high school). Blended technology learning environment configurations might include the following:

- A single computer with desktop publishing capacity in the elementary classroom, with a set of twenty-five portable, infrared writing devices effectively supports technology enhanced writing and publishing initiatives at less than one-fifth the cost of a writing lab (twenty-five networked desktop systems @ $1,500 each = $37,500 versus one desktop publishing computer @ approximately $2,500, plus twenty-five AlphaSmart devices @ $200 each = $7,500); both environments would require a scanner, digital camera, and printer

- A cluster of classroom computers located in the middle school science classroom, combined in a classroom set of graphing calculators or hand-held computers with scientific probes/sensors provides one-to-one data collection and manipulation capacity and sufficient computer resources for small group/team analysis and presentation

- Multiple mobile laptop/tablet computer labs in the high school environment allow research and computing power to "come to the students," rather than requiring the students to "come to the computer lab," significantly reducing lab "downtime" and movement of students while providing one-to-one computing capacity in the content classroom where instruction generally takes place and additional resources exist

The role of the touch-tone phone in the classroom is also evolving as both a communication device and a learning resource. Classroom telephone systems are now significantly less expensive to install than intercom systems in new construction and provide greater flexibility for both student and teacher. With the increase in toll free numbers, students can use the phone to contact organizations, businesses, experts, and other information sources. These resources are generally identified during Web research, phone calls are scheduled using e-mail when a specific individual is involved, and questions/issues are frequently faxed ahead of time for effective use of the time available for the phone call.
4.1.15 School-level Decision Making

The effective integration of technology resources into individual classrooms across the M-DCPS will occur more as an evolution, rather than an event. The infusion of instructional technologies into multiple facets of daily practice will occur slowly over time as paradigms regarding teaching, learning, and the role of technology shift. The type and availability of computing resources will affect the speed and degree of change within individual teachers, classrooms, schools, and the district as a whole.

The district is currently reviewing the status and the location of computer resources at each grade level, based on the instructional needs identified by teachers at that grade level. M-DCPS instructional leadership supports the development of models/configurations for creating technology learning environments that support the variety of learning/teaching needs at the primary, elementary, middle school, high school, and adult learner levels in classrooms, large instructional spaces, and labs.

Based upon the models/configurations available to create technology learning environments, each school-based continuous improvement team will select those strategies that best meet its highest priorities. Equitable distribution and access does not necessarily mean identical resources at all schools/facilities, but rather the distribution of resources to meet the instructional computing needs of all learning communities.

4.1.16 Mobile Computing Options

The research and best practice information in the following section supports recommendation LE&SF-2: Expand Wireless Mobile Computer Environments.

Advances in the portability of computing devices (they seem to keep getting smaller and smaller while becoming ever more powerful), the improvement in battery capacity, and increased capacity of wireless networking solutions has fueled the growth of mobile computing options and usage.

Components

Described above in multiple sections, mobile computing options range from primary learning tools, such as the LeapPad devices, to fully functional laptop computers. The most popular devices readily available on the educational market include:

- primary learning tools (for example, LeapPad devices)
- word processing devices (for example, AlphaSmart and Neo devices)
• hand-held computing devices (hand-held computers, graphing calculators)
• hybrid computing devices (Dana)
• laptop and tablet computers

In addition to the individual computing devices, most mobile computing solutions include a storage or recharging cart/station, a printer or network access to printing devices, wired or wireless access to the school network and the Internet (may be a wireless router), and a projection device. Specially designed carts and cabinets are available for most all of the devices described.

Benefits and Challenges

The benefits of employing mobile computing solutions are numerous:

• resources can be moved on demand to minimize down time of technology resources and maximize return on investment
• mobile devices can used, put away, and used again as class time and activities require, becoming more of a learning tool and less the focus of instruction
• wireless and infrared capacity supports the sharing and beaming of information from student to student
• resources can be taken from within the classroom into the world to collect data outside, on field trips, in the halls, and other environments not equipped with computing resources

Likewise, over time a number of challenges have also been identified:

• smaller and more portable devices are subject to increased vulnerability to theft, damage, and loss
• longevity of rechargeable and conventional batteries and the need to recharge (and keep recharged) batteries in a logical fashion can cause usability issues with shared resources
• movement of carts/cabinets in multiple-level facilities can raise safety concerns, as well as access issues in modular and relocatable classrooms

4.1.17 Peripherals

The peripheral devices available to students and teachers significantly enhance classroom learning environments. It is expected that most teachers and students will have access to a wide variety of peripheral devices including projection devices, printers, scanners, cameras, CD-ROM/DVD burners, and other devices such as probe, meters, and storage devices. The long-term costs of consumables related to the use of peripherals (ink cartridges, paper, toner, blank CDs, bulbs) is a major factor in selecting and setting standards for peripheral devices.
**Projection Devices**

With respect to projection capacity, many districts are budgeting for permanent large group display capacity in each instructional area. The size of even a large TV/monitor has not proven sufficient to display complex data or Web-based information. This projection capacity may be in the form of a ceiling mounted projection device and/or an interactive white board for each classroom. Over the past five years, projection devices have dropped significantly in price, have increased in their brightness and clarity, and are less affected by ambient light conditions.

Many districts already own portable projection devices and LCD panels combined with overhead projectors. These devices should be deployed regularly to emphasize their potential and to engage teachers in new teaching and learning strategies.

Document cameras/projectors are also available that allow you to project three-dimensional items, original print resources, dissection specimens, the screen of a hand-held computer or graphing calculator, and just about anything that will stay still for the cameras to capture and display the image.

Devices are also available that mount on a traditional whiteboard (non-electronic) with suction cups. One such device is the Mimio that connects to a computer and turns it into an interactive whiteboard. Using proprietary holders for the different colored markers, students are able to see what they draw on the white board converted into a digital image on the computer. This digital image can then be saved, printed, and/or enhanced with a draw program.

**Printers**

District IT staff and instructional technology leaders are investigating a number of networked printing solutions. The cost of inkjet printers has dropped so low that for the price of four-to-six ink cartridges, the original price of the printer has been exceeded. Schools are looking closely at networked printing solutions, color, black and white, and photo quality that provide the best return on investment. These include printers capable of accepting an IR signal from the AlphaSmart, Dana, Neo, and hand-held devices.

**Cameras**

Likewise, the cost of digital cameras has dropped significantly. Many models are able to capture stills, motion video, and sound. The resolution of the image quality and the amount of memory for storing images appear to be the factors most influencing price. In addition, 35 mm film can now be developed into digital equivalents as well as traditional prints, allowing students to capture field trips and special events on inexpensive...
disposable cameras, in addition to digital cameras. These images can then be compiled into presentations, incorporated into Web sites, developed into pictorial essays and other writing assignments.

Other Devices

CD-ROM and DVD burners will be required for storing, saving, and/or archiving the songs, movies, Web sites, projects, and presentations that students are developing with tools such as iMovie and iPhoto. Once graphic and motion images are incorporated into student projects, memory requirements quickly exceed floppy disk capacity. Flash memory cards are available to expand the storage capacity of hand-held computers and digital cameras; USB memory sticks are becoming increasingly popular for movement of large files or multiple files from one source to another on laptop and desktop devices with USB ports.

In addition to storage devices there are other peripherals for investigation in the sciences, such as digital microscopes, probe ware, meters, and gauges that turn analog, real-world input into digital images and digital data for manipulation.

4.1.18 Adaptive and Assistive Devices ~ Universal Access and Design

In the area of special education great strides have been made in the development of adaptive/assistive devices and software enhancements. Technology has the ability to help compensate for the hearing impaired, visually impaired, mobility impaired, learning disabled, and otherwise educationally challenged child. Special software programs combined with custom input and output devices allow the mute to speak, the blind to print, and the palsied to keyboard, to identify just a few. Technology allows for the recognition of speech to execute commands, printers to produce Braille efficiently and effortlessly, enhanced visual images for the visually challenged, audio output for the blind to “hear” the output of a monitor, a wide variety of alternative input devices for the young and otherwise disabled, and electronic communication among the deaf community. This unique population of learners begins to communicate and compete on the same level as other students with the integration of universal access and design technologies in schools. In addition, all students with varying learning styles can benefit from universal access and design features available on workstations located throughout the school facility.
4.1.19 Information and Technology Resource Center

Located centrally within the school, the information and technology resource center combines the roles of today's library services, audiovisual/media departments, and technology center into one information and technology resource center for teachers and students. Four specific environments are incorporated to the conventional library area:

- technology research station(s)
- student workstations
- technology lending center
- video control room

All computers in this area would be connected to school and district-wide network, providing access to printers, the www/Internet, data files created in other classes, and network applications and devices.

Information and Technology Resource Center Configuration

The library media area is defined by its multiple purposes. Given the combined functions of providing access to information, as well as a place to process the information, the information and technology resource center offers students and teachers an arena for extensive research and production opportunities. While this configuration is the least suited for formal large-group presentations, it serves as a resource-rich facility where independent and small-group learning are encouraged.
Checkout Desk

The check-out desk is the area where the media center/library resources are taken out and returned by students and teachers. It is advantageous to have a computerized circulation system with bar code scanning available. With network connectivity available, students and teachers can access the availability of books and other library resources from their classroom or home. Generally a voice/data outlet is needed.

Electronic Card Catalog

The arrangement for electronic card catalog access is important in providing the advanced means to locate information available within the media center/library as well as the external resources that may be available. Identifying the location and the number of workstations that will be available for student usage is necessary so that the cabling paths and quantity of cables can be planned. Generally high-density data or a voice/data outlet with both used as data is required. Access to a local or networked printer is recommended so that patrons can print as needed.
**CD-ROM/DVD Multimedia Areas**

The availability of CD-ROM and DVD resources as well as multimedia workstations for on-demand student and teacher usage will be available in the media center/library. The data and video cabling for these workstations must be planned. It is important to plan both CD-ROM/DVD workstations as well as multimedia workstations so that cabling paths can be identified. Depending on the number of workstations connected, one or more high-density data or voice/data outlet is required. A jack for one or more printers should be included in the design of this area.

**Student Workstation Areas**

The availability of workstations for on-demand student and teacher usage should be available in the library. The number of workstations varies based on available space and local preference. The data cabling for these workstations should be arranged to allow additions should more workstations become available. The main concern becomes location and furniture type. Therefore it is important to plan for the maximum workstation configuration from the start so that cabling paths can be identified since it generally is cheaper to pull cable once than to do it on two occasions. Based on the number of workstations in the area, one or more high-density data or voice/data outlet are required. A jack for one or more printers should be included in the design of this area.

**Wireless Network Broadcast**

Wireless routers will be located within the information and technology resource center so students with wireless computing devices can access Internet resources without using student workstations, thus allowing more students access to existing resources.

**Office**

The library office areas also need to plan for integration with the technology network system. The location the computer workstation table(s) or desk(s) is needed to locate the data network outlet(s) effectively and thus define the number of voice/data cables required. It is recommended that at least one voice/data outlet be placed in each library office.

**Library Management**

The current library management and information system is Follett’s Destiny Library Manager. Destiny is K-12 based, user-friendly that manages catalog, circulation, and library management. Destiny can be
accessed over the school's local area network, the district’s wide area network, or over the internet. Records are catalogued in US MARC-record format. Destiny provides fully integrated components to provide on-line:

- maintenance of bibliographic data
- circulation data
- cataloging procedures
- public access
- circulation control
- serials control
- acquisitions
- report generation
- system administration
- access to other libraries by using standard protocols
- access to research databases and on-line magazines and journals
- placement of materials on reserve
- context-sensitive help for ease of use by patrons
- access to student information components

As an interface or connection for instructional resource management, the system can provide options for users to view, schedule, reserve resource materials, and establish private collections of classroom materials remotely.

The system also can provide for retrospective conversion by internal staff, or by shelf lists that are sent to external conversion agencies.

4.1.20 Distance/Virtual Learning Resources

Distance/virtual learning are increasing in popularity within M-DCPS. District leadership seeks to outfit high schools and middle schools and eventually all elementary schools, with the technology resources necessary to provide students and teachers with access to courses and learning opportunities via distance learning. As the cost and complexity of distance learning technology continues to decrease, this capacity will become more widely embraced throughout the district. Florida Virtual High School is an example of the growing popularity of this learning strategy. Being able to broadcast instruction from a central location to multiple sites around the district is another method to ensure equity of access to learning resources, especially special courses such as Advanced Placement offerings and world languages.
**Distance Learning Configuration**

The distance learning classroom in its most sophisticated form provides for real-time, two-way audio/video/data transmission from two or more remote locations. A collection of large screen monitors, video cameras, microphones, speakers, and a telephone/fax allow students (teachers or school-age children) to participate actively, asking and responding to questions in a class consisting of potential participants from across the nation.

The multiple monitors and video cameras capture and display participants and activity at the different remote sites. One video camera is generally dedicated to projecting instructor support materials in the form of either computer generated images, maps, wall charts, close-up hands-on demonstration (dissection), or hand-written notes. Likewise, microphones and speakers capture and transmit "classroom" oral presentations and discussion. The facsimile machine allows the instructor to send quizzes, tests, and assignments to the "class" at the appropriate time. Students may also submit lengthy or confidential questions to the instructor via this media. The console to control the flow of voice, video, and data signals within this environment generally requires a custom design specific to each individual location.

The distance between remote sites may be within buildings in a single town or among schools across the nation. Changing regulations within the telecommunications industry and technological advances involving the transmission of voice, video, and data hold the potential to dramatically decrease the cost and complexity of distance learning configurations. In the past, the electronic signals sent and received were carried via some combination of satellite, ITFS, fiber optic and coaxial cable. More recently, streaming video broadcasts over the Internet are being explored for this use.
The distance learning classroom is designed primarily to extend learning beyond the perimeters of the school site. Because it features two-way communication, the range of possible opportunities in which to expand curriculum offerings is virtually limitless. Both staff and students can take advantage of on-site offerings that would otherwise be unavailable to them. With the inclusion of cable TV access, another dimension of learning sources is opened for the educational community. By using video networking capabilities, long-distance conferences can be arranged, participation in national forums is possible, and direct access to experts in the field becomes a reality. This form of learning is firmly grounded in communication and mutual networking with others who would otherwise be unavailable as resources.

4.1.21 Audience Response Systems

In general, an audience response system (ARS) is any device or process that elicits feedback from a targeted audience. Over the years in the classroom this has included paper-and-pencil questionnaires, raised hands, or flags/symbols.
More recently ARS has been associated with a computerized system by which the audience participants enter responses to questions on hand-held computer terminals. These terminals transmit individual responses wirelessly back to a computer that instantly tabulates the data, and then (typically) displays a summary of the results for the audience to review.

ARS systems have been used in the business environment and by the entertainment industry for a number of years for presentation support (general Q&A), demographic surveys, opinion polls, voting, elections, quizzes and tests, group decision making, and game shows. Just recently has this technology been retrofitted for use in the educational arena. One of the most popular systems is by e-Instruction (Classroom Performance System CPS).

4.1.22 Virtual Advanced Community Learning Centers

Through the development and implementation of Virtual Advanced Community Learning Centers, the district seeks to expand and enhance these options to provide learning opportunities to all Miami-Dade County residents, regardless of whether or not they attend M-DCPS. The objectives of the program are to:

- supplement/increase student achievement
- repatriate disenfranchised students and parents
- increase student enrollment (FTE) through virtual/on-line learning
- expand course options to M-DCPS
- foster collaboration with community/social service organizations, public libraries/museums, local businesses and industries, and institutions of higher learning (University of Miami, Barry, etc.)
- obtain partial FTE enrollment for home schoolers and charter school participants
- support timely delivery of staff development
- qualify M-DCPS as an alternative service provider under NCLB guidelines

Program Benefits

Miami-Dade County residents will enjoy the following program benefits:

- user-friendly learning opportunity directory
- secure access to on-line/virtual courses
- Web-based occupational training programs
- higher education services
- educational vouchers for community college programs
- independent, community-based work study projects
- equipment loan/lease programs
- high-speed Internet access connectivity subsidy
- self-paced computer tutorials
- on-line academic and career assessment
- software for enhancing English language proficiency
- computer-based learning monitoring and management system
- staff development programs
- mentoring, coaching, and career counseling

**Organization and Staffing**

The Virtual/Advanced Community Learning Centers will be comprised of one main hub and R&D location with satellite support and counseling centers in each area of the county. The centers will be staffed by career/occupational counselors, educators (including literacy specialists), and technologists. Hours of operation are from 9:00 am to 9:00 pm Monday through Friday and 9:00 am to 5:00 pm on Saturdays.

**Funding Options**

The federal government has appropriated funds for expanding community technology centers to provide technology training to disadvantaged residents in economically distressed urban communities under the technology component of NCLB. The Virtual Advanced Community Learning Centers model facilitates M-DCPS in reaching a more contemporary perspective by shifting out of the education industry into the learning business while at the same time increasing net operating revenue.

**4.1.23 Wireless Networking Using ITFS Channels**

Synergy Broadcast Systems provides M-DCPS a video on demand application including a browser-based interface that takes the viewer through the search and order-entry process to select and play a video either directly to their television set in a closed circuit environment or streamed to their desktop. In M-DCPS SBS provides video on demand or viewer scheduled programming on 10 ITFS channels that are available to over 330 schools in the district. Teachers can order programming via their computer or through a phone interface that provides interactive ordering. Some of the benefits of this system are that:

- Educational programs can be broadcast over local cable systems.
- Programs can be delivered as video on demand to classrooms or desktops.
• Teachers can schedule and request programming be broadcast at specific times for viewing in their classrooms. Program control is also possible using the Web Browser control applet.
• Programs can also be broadcast over digital networks to classroom televisions and lecture halls.
• Multiple campuses can be connected via ITFS, Fiber, or broadband technology to better manage resources and allow schools to share content.

The FCC requires that the channels be used solely to deliver instruction, or to partner with companies (Wireless Cable) that deliver a subscriber-based video service that competes with land-based cable television systems to deliver entertainment programming. These ITFS channels have a relatively short range (20-35 miles). More information about ITFS can be found at the following address: http://itfs.org/index/about_ITFS.

The convergence of video, voice, and data communications over a common IP infrastructure creates the opportunity to use some of M-DCPS’ channels for wireless. Leadership is exploring the technical design approaches correlated with seeking funds to purchase and operate transmitter systems and the reception equipment that is required at each receiving site.

Such a district-wide IP network could not only transmit digital content at high speed but also provide backup should all or a part of the wired WAN fail. Although the wireless ITFS network provides significant bandwidth, the limit of ten channels will not allow such a system to replace the current WAN, of which the bandwidth to each school is being increased and is being upgraded to fiber optic cable.

4.1.24 Matching Learning Environments to Instructional Activities

The following presents an overview of the ways learners at all levels are likely to use the many learning environments described in this document.

**Primary Learners (PreK to Grade 2)**

The primary learner is likely to use the learning environments described in the following ways:

• alternative/adaptive/assistive input devices
• group creative writing experiences
• graphing and manipulating of group data
• remediation and enrichment activities
• teacher workstation to model and direct collaborative activities with projection capacity
• creativity and exploratory technologies rich with graphics and sound
• CD-ROM interactive storybooks
• computer-managed instruction
• group multimedia production
• student workstations in the classroom for drill and practice
• introduction to numeric calculators to embrace and reinforce math concepts
• beginning keyboarding activities
• access for individual exploration, technology awareness, and initial exposure to basic computing skills
• introduction to basic paint program elements
• Integrated Learning System for skills mastery
• storybook selection
• author studies
• technology resources awareness
• introduction to on-line pen pals and/or information experts

Intermediate Learners (Grades 3 to 5)

The intermediate learner is likely to use the learning environments described in the following ways:

• short creative writing experiences
• graphing and manipulating of data
• remediation and enrichment activities
• creativity and exploratory technologies rich with graphics and sound
• student workstations in the classroom for drill and practice
• keyboarding skills
• computer-managed instruction
• creative writing activities
• interactive, multiple-ending story development
• regular use of numeric calculators
• introduction to graphing calculators
• mastery of keyboarding skills
• writing activities
• lab access for initial exposure to new productivity applications and tools
• introduction to graphic design elements
• basic computer literacy skills development
• Integrated Learning System for skills mastery
• data gathering and research
• author studies
• technology resources awareness
• school news broadcasts

Middle School Learners (Grades 6 to 8)

The middle school learner is likely to use the learning environments described in the following ways:

• collaborative multimedia presentations
• class/school newsletters
• micro-computer-based lab explorations
• groupware activities and simulations
• telecommunications projects
• daily journals
• problem-solving technology applications
• creative and expository writing activities
• research, and data collection and manipulation
• regular use of graphing calculators in algebra
• data gathering for research and writing activities
• electronic note-taking in school and during field trips
• use of CBL (computer-based lab) probes and meters connected to graphing calculators and computers for scientific data collection and manipulation
• communicate via e-mail
• ongoing curriculum integration activities
• cross-content research and writing assignments
• "technology as a tool" activities
• electronic and on-line research in content areas
• identification, synthesis, and organization of information
• independent study, skills drills, homework
• world languages studies
• broadcasts of projects and plays to other facilities
High School Learners (Grades 9 to 12)

The high school learner is likely to use the learning environments described in the following ways:

- collaborative multimedia presentations
- desktop publishing community services
- original research and publications
- real-world, task-specific technology applications
- school yearbook
- integration of data collected across disciplines
- school/community newsletters and bulletins
- collaborative projects addressing global issue
- sophisticated use of graphing calculators in advanced mathematics courses
- data gathering for writing, research, and presentation projects
- electronic note-taking in school and at remote/off-site locations
- use of personal digital assistants for information, time, and school activities management
- use of CBL (computer-based lab) probes and meters connected to graphing calculators and computers for scientific data collection and manipulation
- communication via e-mail
- CAD/CAM design and development lab
- simulated office automation distributed network
- programming and advanced placement instruction
- data collection and transfer via telecommunications
- student as mentor/technician/assistant program
- in-depth electronic and on-line research
- low enrollment courses (on-line/virtual AP courses)
- advanced placement courses
- courses with national instructor shortages
- community broadcasts

Adult Learners (Beyond Grade 12)

The adult learner is likely to use the learning environments described in the following ways:
• access to Internet/WWW from home via modem
• desktop publishing resume/marketing materials
• original research and publications
• networking with community members
• school/community projects
• real-world, task-specific technology applications
• CAD/CAM design and development lab
• simulated office automation distributed network
• programming/network management instruction
• word process, database, spreadsheet basics
• sophisticated use of graphing calculators in advanced mathematics courses
• data gathering for writing, research, and presentation projects
• electronic note-taking at meetings, seminars, and/or courses/classes
• use of personal digital assistants for information, time, and schedule management
• communication needs addressed via e-mail
• data collection and transfer via telecommunications
• mentor/technician/assistant program
• in-depth electronic and on-line research
• adult education courses
• world languages courses
• remote staff development opportunities

4.2 Teaching Environments

The technology resources in school districts with the greatest potential for implementing change and creating change agents are those assigned to the teacher in the classroom. This includes the computer assigned to an individual teacher to assist with teaching, learning, and management of daily classroom functions. Whether it is a full-size desktop system or a portable model, the acknowledgment that educators require tools at least equivalent to those used by students is critical to the successful integration of all other technology enriched learning environments.

To manage the emerging diversity of today's classroom, the individual teacher configuration should provide confidentiality and portability with video out and large-group projection capabilities and high-speed network connectivity. This system should be compact enough to travel with the teacher who provides
instruction in a variety of classrooms and into the homes of all educators. Access to the school network allows for flexibility in lesson planning, preparation, resources selection, and reporting purposes.

Educators have found the introduction of new technologies via specially configured systems both successful and economical. Teachers and students learn and work together with computer systems that have all the necessary software and peripherals in place and are frequently included as a component of a new instructional initiative.
4.2.1 Teacher Station

The teacher workstation area normally is located toward the front of the room in proximity to the teacher's desk. The exact location needs to be determined on a room-by-room basis. Access to voice, video, and data communications should be available at this location. Thus, two voice/data cables and one video drop cable should be brought to this area. This allows access to a telephone, the Internet, and the video programming distributed throughout the school. VoIP may soon eliminate the need for the separate voice connection.

Figure 4-9: Teacher Presentation/Management Station

4.2.2 Laptop versus Desktop Teacher Computers

A highly effective approach to enabling teachers to improve productivity in their professional tasks as well as in their instructional delivery is to provide them with portable computers for use in the classroom and at home. Voluminous research has indicated that the staff members who use computers in their daily lives and/or profession are highly likely to use them effectively with their students. M-DCPS seeks to provide computers to teachers who undertake appropriate staff development activities or who otherwise have obtained specific technology competencies that ensure effective use of the equipment. In some districts, a portable computer has been designated as the classroom unit that can be used for full-class activities, demonstrations, or access to district e-mail or other important information resources. Although it may not be an economically feasible approach for M-DCPS at this time, measures should be taken to encourage availability of portable computers to all instructional staff. The district will negotiate favorable pricing from vendors for portable computers that have the prescribed capability to use applications standard to the district and to communicate effectively with communication and information systems, and that are able to access the Web.
4.3 Administrative Management Environments

In addition to needed learning technologies, central office administrators, school administrators, and support staff at all locations require sufficient technology resources to manage their work and meet the district goal of becoming an efficient and effective organization. Administrative computing resources within each M-DCPS school include modern workstations, printers, and telephones equipped with voice mail capacity.

To support school instructional technology services, several building-level systems must be in place. These include a telephone system with voice mail; network servers (Web, fileserver); Ethernet switches (10/100) to interconnect workstations and servers; a router that connects the school to the district network and the Internet and district applications at 1.5 Mbps or higher; and an uninterruptible power supply (UPS).

Upon installation of both learning technologies and administrative technology resources, school leadership should require configuration/set-up and testing of all computer systems prior to acceptance.

4.4 Facilities Technology Infrastructure: Standards

The research and best practice information in the following section supports recommendation LE&SF-4: Establish and Maintain Infrastructure Standards

In addition to the manner in which technology resources are configured, the capacity of each with respect to a few key variables will also significantly affect their functionality within the learning environment. These key variables include network access, e-mail and World Wide Web access, projection capacity, and cable/distance learning capacity. Planning for appropriate wiring strategies throughout district facilities will significantly enhance the functionality of the technology enhanced learning environments discussed previously.

M-DCPS schools require technology resources for instructional and administrative use that are flexible, robust, and dependable. Students and staff members will use technology to access information and communicate electronically with the global community: parents, government, universities, and the business sector. Staff and students will have the ability to receive educational programming and development opportunities through a wide variety of sources.

Classrooms and other instructional spaces will require the greatest degree of flexibility possible with respect to both current and future potential use. The ability to change and adapt to emerging learning technologies should be incorporated into the design.

It is absolutely imperative that ITS staff, the school principal, media specialists, and teachers be included from the beginning in the process of configuring the
unique requirements of every classroom and lab for data locations, computer placement, and usage. To design technology learning environments without their involvement will shortchange” both the district and most importantly the students.

4.4.1 Space Configuration Models

The use of specific rooms within a school will determine the types of technology outlets best suited for the environment. Outlet placement strategies are needed for each type of school space:

- instructional space configuration models
- non-instructional areas
- specialty areas

The following sections discuss strategies for addressing each of these situations. These are suggestions for assembling the wiring infrastructure and outlets described above.

4.4.2 Instructional Space Configuration Models

Space configuration models presented in the following tables define the technology infrastructure for the various types of spaces in each building. Each building does not have each model and one building will have multiple types of various space models. It should be noted that outlet locations depicted are approximate.

Classroom

Teachers should have an outlet near their desk for voice, data, and video. Although the facility design includes RF broadband video distribution, it does not incorporate the use of TV monitors for new construction. Instead, high-lumen video projectors will be ceiling-mounted and will be connected to the teacher workstation through a media control panel.

The media control panel will connect to the teacher’s laptop or desktop via USB 2.0 or Firewire and allow a wide range of video to be displayed on the teacher’s computer. The media control panel has a built-in cable TV tuner connected to the school’s RF network, allowing the teacher to view and display to the whole class via the ceiling-mounted or other projector. It also will display video from a VCR, camcorder, DVD player, etc. through the auxiliary audio/video input (S-Video or composite). If attached to a camcorder, the media control panel will also enable video conferencing over the Internet.
Instructional Classroom

Outlets:
1 – T
1 – 4S
1 – 2S

Computer Lab

Computer lab

Outlets:
1 – T
9 – 4S
**Science Lab**

<table>
<thead>
<tr>
<th>Science lab</th>
<th>Outlets:</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>1 – T</td>
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<tr>
<td></td>
<td>4 – 4S</td>
</tr>
</tbody>
</table>

Install raceway high on wall.
Raceway up with 1-1/4" sleeve through wall.

Install large section raceway low on wall at outlets.

**Media Center**

<table>
<thead>
<tr>
<th>Media Center</th>
<th>Outlets:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 – M</td>
</tr>
<tr>
<td></td>
<td>3 – 4S</td>
</tr>
<tr>
<td></td>
<td>1 – T</td>
</tr>
</tbody>
</table>

Install raceway high on wall.
Raceway up with 1-1/4" sleeve through wall.

Install two channel raceway low on wall.

Install raceway low on wall.

Install raceway high on wall.
Raceway up with 2" sleeve through wall.
4.4.3 Non-academic Area Space Configuration Models

All school facilities contain a number of spaces that are not used for direct student instruction. These areas are identified as non-academic areas. When planning wiring strategies and outlet selection for administrative offices, teacher workrooms, auditorium/stage areas, gymnasium/sports areas, and cafeteria/lobby areas, the district should refer to the proposed guidelines for non-academic areas in the following sections.

Administrative Offices

The administrative office areas need to plan for integration onto the technology network system. The planned location of a desk or workstation table is needed to locate the data network outlet effectively and thus define the number of voice/data cables required. It is recommended that at least two voice/data cables run to each administrative outlet location.

Office areas have the following needs:

- two networked stations per administrative office site; four per departmental office
- integrated fax
- one telephone
- one phone line per station
- high-quality printer

Conference areas should include:

- video, voice, and data drops
- electric power availability (quad per drop)
- capability to support computer, printer, telephone operations, and video monitor

In certain administrative offices, such as the principal’s or superintendent’s the inclusion of video drop cables might be considered.
Office

Main Outlets:
- 6 M
- 1 T

Administrative Outlets:
- 1 M

Food Service

Athletic Office

Principal Outlets:
- 1 T

Nurse Outlets:
- 1 M
Conference Room

Outlets:
1 - T
1 - P

Utility

Miscellaneous Receiving Boiler room

Outlets:
1 - P
Install additional type 'P' outlets in large machine rooms, in equipment penthouses and adjacent elevator equipment for -+cab telephones.

Teacher Workroom

Teacher workrooms represent areas where teachers can access the technology network for class preparation or administrative information input or access until workstations can be placed in the classrooms. These areas should be planned to allow the teacher ample space in a private environment. Therefore the identification of an area where the workstations can be located is important. The exact location and quantity of workstations will vary depending on the room configuration. Allowance for a workstation area of approximately 36' wide and 30' deep is recommended.
4.4.4 Special-use Space Configuration Models

**Auditorium/Stage Areas**

The auditorium/stage area represents a presentation area for the entire school. The ability to present information to a large group is particularly important and, therefore, requires technology tools, such as video projection systems and large-screen displays. The fixed mounting of these devices normally is recommended because of the set-up time required. If these devices are planned and the locations are identified, both data and video cabling can be arranged. Usually it is recommended that multiple video cable drops be located throughout the auditorium to provide videotaping or live broadcast of events.
**Gymnasium/Sports Areas**

The arrangement for video drop cabling in the gymnasium and other sports-related areas is recommended to support the ability to videotape or provide live broadcasting of events held in these areas. Planning for multiple video drops provides greater options for camera angle coverage. The gym should have the following equipment:

- Data/Video ports and monitors that can be used for video displays of electronic bulletin boards
- Video projector on mobile stand, video monitor on mobile stand, large, electric front screen

<table>
<thead>
<tr>
<th>Gymnasium</th>
<th>Outlets:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - M</td>
<td>1 - V</td>
</tr>
<tr>
<td>Install</td>
<td>Outlet V</td>
</tr>
<tr>
<td>Outlet V</td>
<td>directly</td>
</tr>
<tr>
<td>below</td>
<td>Outlet M</td>
</tr>
</tbody>
</table>

Install raceway at ceiling structure

**Cafeteria/Lobby Areas**

The Cafeteria and Commons areas should have the following equipment:

- Video ports and monitors that can be used for video displays of electronic bulletin boards
- Data ports throughout areas
- Video projector on mobile stand/Fixed position
- Large, electric front screen
- Fixed monitors in various locations

For Food Service:

- Data ports for point of sale/scanners
- Voice port and telephone
4.4.5 Guidelines for New Construction: Relocatables and Modulars

The research and best practice information in the following section supports recommendation LE&SF-5: Continuously Update IT Prototype and Construction Specifications.

The district has identified a timeline for replacing relocatables (portables) with either modular classrooms or new classroom space. The timeline for this replacement is articulated in Appendix E - Capacity Additions of the
District Educational Facilities Plan 2003/2004-2007/2008. These capacity additions will bring network connectivity to classroom space that is currently underserved technologically.

The district will no longer use portable classrooms (not networked) and instead will use modular classrooms that are pre-wired for network capacity when necessary.

4.4.6 Building Wiring Standards

The wiring infrastructure for voice, data, and digital video will use industry standards (NFPA 70 National Electrical Code, ANSI/TIA/EIA 568-A Commercial Building Telecommunications Cabling Standard, ANSI/TIA/EIA 569-A Commercial Building Standard for Telecommunications Pathways and Spaces and ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications) and will incorporate a combination of minimum Category 5e recommended Category 6 copper wire and fiber optic cable with a twenty-five-year warranty. Some features of the facility’s infrastructure follow:

- Wiring infrastructure will support Ethernet speeds up to 1,000 million bits per second (mbps) (also referred to as gigabit Ethernet) to each classroom and office data outlet. Category 6 cable can support 10 gigabit Ethernet.

- Electronics initially will provide minimum 100 mbps Ethernet to each data outlet. The electronics can be replaced in the future when gigabit speeds are more cost effective without having to change the wiring infrastructure. As the price per port of gigabit Ethernet continues to fall, this should be specified and installed. A rule of thumb should be established: when the cost per port of gigabit is within 75 percent of the cost per port of Fast Ethernet, then gigabit should be installed.

- Testing will ensure that all circuits are installed properly, which means that the circuits meet TIA/EIA TSB-67 transmission performance specifications.

All facilities should adopt a voice and data wiring system based on industry standards (ANSI/TIA/EIA) 568B standard for structured building wiring. This standard covers small, medium, and large buildings as well as "campus" environments where several buildings are on the same property. (M-DCPS has standardized on 568A, and may continue to follow this; however, the 568B is more common and a best practice for this reason only)

New wiring should use four pairs (eight wires) of enhanced Category 5 unshielded twisted pair (UTP) wires for each circuit to a modular jack in each wall plate. Enhanced Category 5 UTP supports analog phones, fax, Integrated Services Digital Network (ISDN) phones, two pair RS232D
data lines, LocalTalk, Ethernet (10BaseT), Token Ring (4/16 mbps), Ethernet (100BaseTX), FDDI over copper (100 mbps), Asynchronous Transfer Mode (ATM) and gigabit Ethernet (1,000 mbps). The network backbone incorporates fiber optic cable that supports speeds up to 1,000 mbps. The copper/fiber network wiring will support voice, data, and interactive video.

For distribution of a large number of simultaneous one-way video programs, the district should standardize on cable TV industry standards.

Table 4.10 below summarizes typical minimum wiring recommendations for voice, data, and video communications. It is understood that M-DCPS uses EIA/TIA 568-A pinning, there is no practical difference other than the industry has accepted 568-B as a more common practice.

**Table 4.1: Minimum Building Wiring Recommendations Summary**

<table>
<thead>
<tr>
<th>Infrastructure Area</th>
<th>Component</th>
<th>Data</th>
<th>Voice</th>
<th>Video</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Area</td>
<td>Connector</td>
<td>RJ-45</td>
<td>RJ-45</td>
<td>F Type</td>
</tr>
<tr>
<td></td>
<td>Pinning</td>
<td>EIA/TIA 568-B</td>
<td>EIA/TIA 568-B</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Face Plate</td>
<td>Composite</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Distribution</td>
<td>One per Work Area</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mounting</td>
<td>Permanent/Wall Mount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>Cable</td>
<td>Enhanced Level 5 UTP</td>
<td>Enhanced Level 5 UTP</td>
<td>RG-6</td>
</tr>
<tr>
<td></td>
<td>Conductor</td>
<td>4-Pair (8 Conductor)</td>
<td>4-Pair (8 Conductor)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Install</td>
<td>Conduit/Cable Tray/Hidden</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distribution Frame</td>
<td>Patching Connector</td>
<td>RJ-45</td>
<td>RJ-45</td>
<td>BNC-Type</td>
</tr>
<tr>
<td></td>
<td>Punch Down</td>
<td>110 Type</td>
<td>110 Type</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Mounting</td>
<td>Wall/Cabinet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructure Area</td>
<td>Component</td>
<td>Data</td>
<td>Voice</td>
<td>Video</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------</td>
<td>------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Backbone</td>
<td>Cable Type</td>
<td>50 µm Multimode (500 MHz*km) (single mode if over 550 m) Fiber Optic</td>
<td>Level 3 UTP</td>
<td>RG-11</td>
</tr>
<tr>
<td></td>
<td>Conductor</td>
<td>24 Strand</td>
<td>100 Pair</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Connector</td>
<td>SC-Duplex Type or RJ45 form factor</td>
<td>Amp 50 pin</td>
<td>BNC-Type</td>
</tr>
<tr>
<td></td>
<td>Mounting</td>
<td>Conduit/Cable Tray</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Campus Backbone</td>
<td>Cable Type</td>
<td>50 µm Multimode (500 MHz*km) (single mode if over 550 m) Fiber Optic</td>
<td>Level 3 UTP</td>
<td>RG-11</td>
</tr>
<tr>
<td></td>
<td>Conductor</td>
<td>24 Strand Multi-mode (or 12 Single-mode)</td>
<td>100 Pair</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Connector</td>
<td>SC-Duplex Type or RJ-45 form factor</td>
<td>Amp 50 pin</td>
<td>BNC-Type</td>
</tr>
<tr>
<td></td>
<td>Mounting</td>
<td>Conduit Under ground/Overhead Pole/Direct Burial</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Room Technology Outlet Types**

Many districts define standard technology outlet configurations for different uses and users. Designation change from district to district and the exact components of the outlets adapt to local conditions. Table 5.2 shows the typical types of outlets defined, where it is used, the types of jacks in the outlets, and a sample graphic of the outlet.
### Table 4-2: Outlet configurations

<table>
<thead>
<tr>
<th>Outlet</th>
<th>Work areas</th>
<th>Jacks</th>
<th>Graphic</th>
</tr>
</thead>
</table>
| T      | Teacher     | 2 - data                                   | ![graphic](image)
|        |             | 1 - desk phone                             | ![graphic](image)
|        |             | 1 - video                                  | ![graphic](image) |
| TV     | Multimedia  | 1 - RF connector                           | ![graphic](image) |
|        |             | 1 - S-video                                | ![graphic](image) |
|        |             | 1 - video in                               | ![graphic](image) |
|        |             | 1 - right audio in                         | ![graphic](image) |
|        |             | 1 - left audio in                          | ![graphic](image) |
|        |             | 1 - VGA                                    | ![graphic](image) |
|        |             | 1 - DVI-D                                  | ![graphic](image) |
|        |             | 1 - USB                                    | ![graphic](image) |
| 2S     | Student     | 2 – data                                   | ![graphic](image) |
|        |             | 2 – unassigned                             | ![graphic](image) |
| 4D     | Student     | 4 - data                                   | ![graphic](image) |
| M      | Administrator| 2 - data                                   | ![graphic](image) |
|        |             | 1 - desk phone                             | ![graphic](image) |
|        |             | 1 - unassigned                             | ![graphic](image) |
| V      | Video       | 1 – RF video                               | ![graphic](image) |
| P      | Utility     | 1 - wall phone                             | ![graphic](image) |

**Notes:**
1. Data, phone and unassigned jacks are RJ-45. Video jacks are BNC type.
2. Data jacks have blue bezel, phone jacks have orange bezel, and unassigned jacks have red bezels. Video jacks have red bezels.
3. Outlets mounted at receptacle height except for 'P' which is mounted at 6" above switch height and the V outlets which are mounted at 7".

These outlet configurations then become the basic building blocks for providing network services within all buildings.

**Wireless Networking for Students, Teachers, and Staff**

Wireless communication is most commonly associated with the wireless connectivity available on cellular phones and hand-held devices. Beyond that, school districts have been exploring the potential of wireless networking for some time because this approach addresses many of the problems inherent in school connectivity. Wireless LANs can provide many of the benefits of hardwired environments in that wireless can accommodate e-mail, Internet access, device sharing, as well as access to administrative systems.

Wireless technology reduces need to drill through walls and pull cable; not every classroom or instructional space requires a wireless transponder to provide network access. A wireless network strategy provides benefits in situations where hazardous materials are located in walls and ceilings, as can be found frequently in older facilities. Like cabling, wireless can be set up to provide service in classrooms, auditoriums, or other learning environments to provide flexibility in instruction and to bring resources in to the arena.

Wireless networks will be considered when it is appropriate and advantageous, such as for mobile labs, learning centers, or for teaching staff. Wireless networking is increasingly seen as a way of allowing all students in a class to use computers without having to go to computer labs. This is one of the reasons this *Information Technology Blueprint* calls for eventually providing wireless networks throughout all schools.

For itinerant teachers who move between buildings or classrooms, wireless networks offer a way to stay connected to the district network from many points on the campus. As computing devices become smaller and more powerful, the vision for effective use of technology in teaching depends on increased mobility and flexibility. By embracing wireless network environments in its planning for technology, M-DCPS will be positioning itself to take advantage of learning opportunities yet to come.

A wireless network exists in conjunction with a wired Ethernet LAN. Desktop or portable computers equipped with wireless network cards interact with network data made available through an access point (AP), which is physically connected to the network switch through the wired network. Deploying APs along a network creates interlocking cells for continuous access so that mobile users can move about without losing connectivity. Typically, an AP can support about a dozen users. Wireless networks should not be perceived as an alternative to the wired networks in buildings. Rather, within limitations, it extends the reach of the wired networks and may offer a degree of flexibility and mobility that
cannot be otherwise achieved. Security and reliability issues are greater with wireless technologies although these are being addressed.

Figure 4-10: Hybrid wired and Wireless Network

The Institute of Electrical and Electronics Engineers (IEEE) have established the 802.11 specifications which serve as the standard to ensure interoperability among RF wireless networking devices. All wireless networking components considered by schools, including APs and adapter cards must be compliant with one of the 802.11 family of standards. The wireless infrastructure in schools will support both 802.11b (11 Mbps) and 802.11g (54 Mbps) wireless networks for general use. The 802.11a (54 Mbps) standard will be used in specialized situations.

Other wireless protocols are emerging. Bluetooth, for example, is a low-power, royalty-free standard that is often viewed as an acceptable way to interconnect smaller devices such as printers, personal digital assistants (PDAs), and cell phones over short distances. Although Bluetooth-enabled products are seeping into the education market, their limited range currently impedes their educational potential.

4.4.7 Wired versus Wireless Networking Solutions

Wireless networks will be installed over time in all schools. Instruction increasingly views wireless networking as a way of allowing all students in a class to use computers without having to go to computer labs. Initially wireless networks will be considered for mobile labs, learning centers, or for teaching staff. Mobile computer labs with wireless network connectivity on recharging carts with fifteen-to-thirty laptop computers will bring computing to any classroom or part of the building. Wireless networks will be dramatically expanded over the next few years to accommodate the one-to-one initiative and its emphasis on mobility.
In making network decisions regarding wired or wireless strategies, major considerations are the speed and security demands of the applications that would be operating in the classroom or learning environment. In some instances, mobility may be highly valued. In other locations, speed or security may be the overriding issue. In most schools, some combination of wired and wireless technologies will be the solution, having a flexible infrastructure that allows for that combination to be adjusted in the future as needed. Just as cell phones have not replaced wired phones, it is expected that wireless communications will complement the wired network infrastructure. Therefore, an effective and forward thinking technology infrastructure design includes both wired and wireless designs with a combination of different wireless protocols and speeds.

It may be imperative to leave the administrative workstations on a wired network to maximize performance and ensure security. Similarly, instructional computer labs can be hard-wired if mobility is not a high priority and usage levels are high. In classrooms, the need for mobility and flexibility is generally high, and wireless may be the preferred strategy. As an example, through wireless configurations, a mobile computer lab with wireless network connectivity on recharging carts with fifteen-to-thirty laptop computers can bring a high concentration of computers into a specific classroom for a short time, a few hours, or days. In information resource centers or library/media facilities, the school may find it desirable to have some desktops that have fixed wiring for research and catalog access, with more flexible wireless space available to accommodate portable computers for use in special projects. Essentially, the network design should seek a balance of meeting requirements for mobility, flexibility, performance, and security.

The bandwidth requirements of streaming video are far more intensive than those for data. Although the delivery of streaming video to classroom computers through newer and higher speed wireless technologies seems to loom in the near future, the district should currently rely upon wired infrastructure in schools for accessing cable television, for media distribution, and for in-house broadcasting. When large data files are used, such as high-resolution photographs, video files, and CAD drawings, a wired network may be required to achieve acceptable response times. A responsible infrastructure design generally incorporates currently available technologies with a view toward leveraging new technologies as they emerge.

Schools may eventually benefit from the full convergence of voice, video, and data delivered over wireless infrastructure. Meanwhile, an appropriate design will consist of a hybrid of wired and wireless technologies. The wireless capabilities on a wired network can position classrooms to take advantage of fully mobile learning environments in which teachers and students carry their various wireless devices with them throughout the school. One goal is to be able to provide unrestricted, flexible wireless access wherever possible, while maintaining wired resources as needed. A reasonable strategy for M-
DCPS, therefore, is to build schools with serviceable and practical technology in the short term and with a design that supports flexibility and openness to change in the long term.
4.4.8 Furniture Requirements

Technology is changing educational facilities in ways that could not have been imagined a few years ago. When bricks and mortar are put in place, they are expected to remain in place -- educational programs are modified to fit the box. With gaps of twenty years or more between capital-improvement projects, schools must develop ways to accommodate the fast pace of technological change and facilitate the use of the latest technology.

Teaching now embraces differing learning styles: independent student work, small-group sessions, larger group discussions, teacher-directed instruction and lectures. To accommodate those styles, schools must have the flexibility to reconfigure instructional spaces regularly. The spaces also must have data and power connections for laptop or desktop computers and possibly for other personal electronic devices. Some specialized lab spaces can be customized with fixed equipment, but most educational spaces will require as much flexibility and adaptability as possible, including technology-free zones with comfortable seating for interaction and communication.

Be flexible

In an effort to attract students to their campuses, colleges and universities have created special flexible spaces and workstations. A visit to construction or renovation projects at most colleges or universities will reveal classrooms, labs, conference spaces, and common areas with wired or wireless computer connections. More students are coming to class with laptop computers to research, communicate, and take notes during class. This has resulted in a major change in what type of furniture is found in classroom spaces. Instead of tablet-arm chairs, more schools are incorporating tables and desks with power and data connections.

Many K-12 schools have been providing computers to all teachers, as well as installing data connections in the rear or side of a classroom and one or more dedicated computer labs in the building. Often, the computers are installed on built-in counters or on top of whatever table or desk is available. Placing these computers in classrooms has created crowded conditions in many areas.

A desktop computer shared by three elementary students at a time would need at least 33 square feet of space (6 feet by 5.5 feet). Twenty-five students with four computer stations will not fit in a conventional 750 square-foot classroom. For a classroom with five computer drops, the additional space would equate to at least 165 square feet, in addition to the space for conventional desks. Some schools have found this additional space for computers in the corridor.
More and more K-12 public schools are following colleges and universities and are creating increasingly sophisticated educational facilities, incorporating technology with spaces sized for specific uses and utilizing non-traditional classroom furniture and layouts.

**Be comfortable**

Ergonomics is not always considered when placing computers in classrooms. Many schools are purchasing furniture based on past practices. Business took nearly twenty years to recognize the benefit of providing ergonomic furniture designed for technology; schools are only ten years into that curve. So it is only a matter of time until schools will be required to provide students with appropriately designed furniture. With regard to technology, televisions, which recently became a fixture in classrooms, are being replaced with projectors because students more than a few rows from a TV monitor cannot see the task bar when computer screens are displayed during class.

Technology requires flexible furniture and specific spaces for computer workstations:

- Student tables with integrated cable trays and separate chairs allow flexibility and wiring from the walls or floor boxes.
- A desktop computer workstation requires a 30-inch by 36-inch workstation. With an LCD screen, the station can be 24 inches deep or with a laptop, 20 inches.
- A chair in front of a workspace takes a 24-inch by 30-inch footprint.
- The rule of thumb for a general computer workstation space is 3 feet by 5.5 feet per student with an additional walking space, or about 25 square feet per station added to the general square footage of the room.

**Be thorough**

There is no right or wrong answer to providing classroom furniture, provided it is appropriate for the school and its curriculum, and is comfortable to use. In the past, school systems bought furniture and equipment based on the least expensive way to provide the maximum number of seats, and looked at previous purchases to buy more of the same. Function, other than a place to sit, was usually secondary if it looked presentable and appeared to be long lasting. Typically in a renovation or new construction project, schools never plan for expensive furniture in the program-development phase; if there were cost overruns on the construction, they simply reduced the furniture, fittings and equipment (FF&E) budget. This lack of funds usually translated to reusing existing equipment or settling for less desirable furnishings.
Schools need to ask how they will be using the space and how often the equipment will be moved throughout a typical day. Also, administrators need to consider which types of services are required (water, electricity, data) as well as the life-cycle cost and the ease with which custodians can clean around the furniture. Schools need to determine the type of computer to be used in the space so that it will have adequate desk space. Before buying furniture with an integrated duplex outlet, the school should check local electrical codes, which typically require that the outlet be hard-wired to the electrical service. UL-rated plug-in power extenders that clamp to the furniture are more flexible and are available in lengths up to 30 feet.

Some schools use access floors for all spaces so that data and power can be provided virtually anywhere. This provides a great deal of flexibility, but it comes at a significant cost. For the majority of educational spaces, a combination of floor and wall outlets, and furniture with integrated raceways, provide flexible configurations. Ceiling drops have proven to be a cost-effective solution, especially in a high-tech environment.

Spaces will be used for a variety of programs and delivery methods. The furniture selected and incorporated as part of the interior architecture will play an increasingly major role in whether a space remains useful as needs change.

**Think ahead**

Some general considerations:

- All facility improvements should include furniture use and layout based on a school's current and anticipated curriculum.
- Movable fixtures and equipment will provide maximum flexibility within an educational space.
- Data and power connections are required in all classrooms. A school should use the latest technology that it can afford. Even with most wireless systems, hard wiring is still required for video transmission.
- A pathway should be installed for future needs, including conduit above the ceiling, conduit through firewalls, and cable trays throughout the facility.
- FF&E must be addressed properly in any construction budget to ensure that the required furniture is provided.
- Tablet-arm chairs most likely will be phased out in ten-to-fifteen years because of technology.
Good works

Massachusetts Institute of Technology (MIT) is rethinking its physical environment for education and is in the midst of a massive reshaping of its campus in Cambridge. Facilities are being designed and redesigned for the specific programs that are housed in the space and are incorporating relevant technology. One of those spaces is the TEAL (Technology Enabled Active Learning) Room, a classroom for ninety-nine students at tables that seat three teams of three students.

Students work on laptops, and the entire room is networked. Work on the laptops can be projected on screens around the room as desired by the instructor. This interaction allows an instructor to facilitate the merging of hands-on learning with lectures and dissertations. Another space is the Aeronautics and Astronautics Laboratory, which was carved into an existing traditional classroom. It was intended that the space should “not be over-designed so that it can evolve.” Students continue to change the space by moving furniture and movable partitions within the boundaries of the hard-walled spaces.

Most of the spaces have tables with data and power connections and are planned for conversion to wireless. Some adjustment is required for testing as it is more difficult to separate students at tables in some of the configurations that work best for the learning process than it was for individual desks.24

Research in ergonomics shows that a well-designed learning environment affects teachers and students physiologically, emotionally, and psychologically. Ergonomics also contributes to a higher degree of learning and information handling (Bowers and Burkett, 1989; Caldwell, 1993; Knirk, 1987; Linton, Hellsing, Halme, and Akerstedt, 1994). However, improperly designed classrooms can impede learning by contributing to teacher and student fatigue, discomfort, and irritation as well as posing distractions. Poorly designed computer workstations affect both the health and productivity of adult workers (Bergqvist, Wolgast, Nilsson, and Voss, 1995; Carter and Banister, 1994), especially posture that leads to musculoskeletal complaints. Preliminary work with children indicates that adjusting the dimensions of the workstation to fit their anthropometric dimensions can significantly improve the seated posture of children performing keyboarding tasks and will result in increased computer task performance (Laeser, 1997).25

24 Chambers, Jeffrey. The Furniture Equation. American School & University, June 1, 2004
4.4.9 Strategies for Physical Security and Student Safety

Security issues cover three major areas: physical security of facilities (e.g., intruder alarms); physical security of technology components (e.g., theft of components); and, data/network security (e.g., protection against hackers).

Ongoing risk assessment will be performed that will identify assets and threats. Security is not absolute and comes at a cost. Cost can be measured in dollars for hardware, software, and staff time; but it can also be assessed in terms of loss from ease of use. The cost of guarding against a potential threat must be weighed against the cost of recovering from it.

Schools may improve the security of technology by:

- installing theft-deterrent devices on computers in classrooms
- expanding intrusion alarm systems with more zones and adding links to central security staff/control
- ensuring that video surveillance covers all areas in which newly acquired technology is concentrated

4.4.10 Electrical Power

Electrical Receptacles

The National Electric Codes (NEC) recommends that each instructional space should have six general-purpose duplex receptacles and one duplex receptacle for each computer and should allow flexibility in their placement. The M-DCPS capitol improvement plan should provide all classrooms with the appropriate NEC recommendation. All new construction will incorporate the new standard. The power upgrades in all classrooms should be coordinated with the implementation of wiring in the schools.

Line Conditions

The schools should be surveyed about power failures, their electrical needs, and the current electrical power if this information is not already available. M-DCPS should work with local municipalities and the electric company to plan for improvements to the system as needed. In addition, M-DCPS should install surge-protection devices on all electrical distribution panels serving technology systems. It will also ensure that all distribution frames include grounding systems in accordance with code requirements.
Critical Design Installation and Utilization Challenges

Potential safety issues in the current and future learning environments must be identified, including a careful inspection of the added electrical power, the location of PVC cable, and the location of cables on floors. All potential safety hazards in the current learning environments must be corrected. Periodic inspections of learning environments will be scheduled for safety hazards created by added electrical power, inappropriate location of PVC cable, and location of cables on floors.

In addition, there are installation and utilization challenges, such as working around sprinkler heads and installing power and wiring to ceiling mounted projection units because of the ceiling and wall construction techniques in facilities of different ages.

4.4.11 Lighting

Lighting in schools should provide a learning environment that enhances the learning process. Lighting should allow students and teachers to perform visual tasks quickly and comfortably. The following Table of Lighting Quality Issues for Sample School Building Spaces provides information about the relative importance of various lighting quality issues for specific school spaces.

<table>
<thead>
<tr>
<th></th>
<th>General Classroom</th>
<th>Computer Classroom</th>
<th>Multipurpose Classroom</th>
<th>Corridor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control of Direct and Reflected Glare</td>
<td>→</td>
<td>↑</td>
<td>→</td>
<td>↓</td>
</tr>
<tr>
<td>Light on Walls and Ceiling</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>→</td>
</tr>
<tr>
<td>Fixture Location Related to People</td>
<td>→</td>
<td>↑</td>
<td>→</td>
<td>↓</td>
</tr>
<tr>
<td>Light Patterns – Uniformity vs Shadows</td>
<td>→</td>
<td>↑</td>
<td>→</td>
<td>↓</td>
</tr>
<tr>
<td>Daylight</td>
<td>→</td>
<td>↓</td>
<td>→</td>
<td>→</td>
</tr>
<tr>
<td>Color Rendering and Color Temperature</td>
<td>→</td>
<td>→</td>
<td>→</td>
<td>→</td>
</tr>
<tr>
<td>Lighting Controls, Flexibility</td>
<td>↑</td>
<td>→</td>
<td>↑</td>
<td>↓</td>
</tr>
</tbody>
</table>

↑ Very Important  → Important  ↓ Somewhat Important

4.4.12 Telephone Systems

M-DCPS uses Nortel Norstar key systems in the elementary schools and the Option II PBX in Middle and High Schools. There are plans to phase out the Nortel Norstar key systems in the elementary schools. All systems are equipped for VoIP when installed.

4.4.13 Business Continuity (Disaster Failure Recovery)

Business continuity at the facilities level addresses the plans and processes to ensure the security of both equipment and data in the event of an emergency and/or crisis. This emergency/crisis might be weather-related (hurricane/flooding), an act of terrorism or vandalism (Columbine High School crisis), or a structural failure (roof collapse). In any event, schools and other district facilities need to align their safety plans with business continuity strategies and procedures to minimize impact to technology systems and data stored digitally. The areas of review include:

Readiness

- identification of areas of vulnerability
- power protection/continuity
- physical security
- physical protection of back up media (store in vault one off site)
- training in process for all staff

Response

- procedures defined for orderly shut down
- protected procedures (recovery staging—for example, plastic sheets and duct tape to cover technology resources in the short term)
- physical security (locks and locked areas to protect space from vandalism or looting)

Recovery

- secondary site identified where services can be rebuilt temporarily
- temporary location within the same facility (may be an option)
- ensured safer space for needed equipment
Reconstruction

- sometimes parallel with recovery
- systems rebuilt in original facility when possible
- new data needs migrated back to original systems from temporary systems

District and School Level Strategies

At both the district and school levels, awareness of potential disruptions is the most successful strategy to prevent disruptions. A large percent of situations requiring some type of data recovery are not caused by natural or catastrophic events, but rather by human error or inattentiveness to existing threats such as computer viruses.

District and school level leadership will identify the types of situations/threats when the school or facility will need to employ business continuity methods/processes. Likewise, schools need defined procedures that bring a priority to actions in the event of potential threats. It is most important to focus upon threats ahead of time to decide needs. In conversation regarding the recovery after Andrew, the importance of teacher gradebooks rose to the surface as an important element to continued tracking of student performance. This was not initially identified as a high priority for business continuity.

This section speaks to the differences in need for strategies at the district and school levels. In any type of emergency situation, the teachers need to be able to secure student information and family contact information as the emergency unfolds. The district would generally be more focused on data regarding staff in all locations, during a time of crisis/emergency.

Back up Procedures and Recovery Models

- school safety plans
- safety plans for All facilities (first response)
- multiple security layers within the district to identify vulnerability of each system

Implementation Challenges

- disconnect between safety plans and business continuity plans currently
- awareness of potential threats/situations that would require deployment of business continuity processes
- appropriate recognition of potential damage
- enhanced back up of lesson plans and student rosters instead of only end-of-quarter information
4.4.14 Telecommunications Rooms (TRs) / Equipment Rooms (ERs)

Telecommunications Rooms (TRs) / Equipment Rooms (ERs) (often called main distribution frames and intermediate distribution frames) must be identified to provide voice, data, and video distribution and services to the school. Telecommunications Rooms (TRs) / Equipment Rooms (ERs) are floor-serving spaces that provide a connection point between backbone and horizontal cable distribution pathways. These locations require a secure environment with adequate electrical power. TR design should consider incorporation of other building information systems in addition to traditional voice and data needs, such as community antenna television (CATV), alarms, security, audio, and other building signaling systems.

TRs provide an environmentally suitable and secure area for installing:
- cables
- cross-connects
- rack- and wall-mounted hardware
- telecommunications equipment

The design of TRs depends on the:
- size of the building
- floor space served
- occupant needs
- telecommunications services used
- future requirements

A dedicated telecommunications distribution facility is necessary because of increased demand for:
- desktop automation
- voice and data integration
- desk-to-desk information exchange
- integration of the other building systems into the structured cabling system

TIA standards specify a structured telecommunications infrastructure that distributes telecommunications services to each individual work area (WA) from the telecommunications rooms. They also provide the interconnection of work areas on the same floor or to other floors and buildings via the backbone facility.
Some buildings will require multiple telecommunications room, but the number of these areas should be kept minimal to reduce costs.

<table>
<thead>
<tr>
<th>Space</th>
<th>Components</th>
<th>Graphic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equipment</strong></td>
<td></td>
<td>Wall mounted equipment</td>
</tr>
<tr>
<td>Small Main Distribution</td>
<td>4'x8' backboard</td>
<td>4' x 8' backboard</td>
</tr>
<tr>
<td>Frame/Equipment Room (ER)</td>
<td>2 - rack frames</td>
<td>12&quot; wide ladder at wall and above frames</td>
</tr>
<tr>
<td></td>
<td>cable ladder</td>
<td>Two equipment frames</td>
</tr>
<tr>
<td></td>
<td>wall to wall</td>
<td>Three 4&quot; sleeves</td>
</tr>
<tr>
<td></td>
<td>3 –4&quot; sleeves</td>
<td></td>
</tr>
<tr>
<td>Medium Main Distribution</td>
<td>2 - 4'x8' backboards</td>
<td></td>
</tr>
<tr>
<td>Frame/Equipment Room (ER)</td>
<td>3 - rack frames</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cable ladder</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ea 4&quot;- sleeves</td>
<td></td>
</tr>
<tr>
<td>Large Main Distribution</td>
<td>2 - 4'x8' backboards</td>
<td></td>
</tr>
<tr>
<td>Frame/Equipment Room (ER)</td>
<td>4 - rack frames</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cable ladder</td>
<td></td>
</tr>
<tr>
<td></td>
<td>wall to wall</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 ea 4&quot;- sleeves</td>
<td></td>
</tr>
</tbody>
</table>

**Small Main Distribution Frame**

**Medium Main Distribution Frame**

**Large Main Distribution Frame**
### Space Components

<table>
<thead>
<tr>
<th>Space</th>
<th>Components</th>
</tr>
</thead>
</table>
| Intermediate Distribution Frame Telecommunications Room (TR) | 1 - 4'x8' backboards  
1 - rack frame cable ladder  
3ea 4"-sleeves               |

### Video Head-End Area

The video head-end area is the room where the video distribution amplifier and other signal processing equipment will be located. Normally it is recommended that this area be near the media center/library, which would facilitate control over resources transmitted on the video system from the same area that normally manages these types of programming resources, videotapes, laserdiscs, TV channel distributions, etc. This area will require ample space for an enclosed 19" equipment rack, adequate electrical power supply, and ample ventilation to prevent room overheating.

### 4.5 New Construction and Retrofits

M-DCPS is planning to undergo a major capital improvements plan in which every school facility will be brought up to a minimum level of operations standard. This process will take five years to complete and will depend on funding which the school is being sought via various mechanisms. In addition to this, many new schools are being planned for new construction (with prototypes being designed) and the phase out of portable classrooms/trailers is a goal. This major capital improvement initiative should move ahead with current technology demands for infrastructure addressed, new standards defined, and future demands considered and planned for as much as possible.
5.0 HUMAN RESOURCES /ORGANIZATIONAL DEVELOPMENT AND STAFFING

Included in the Technology Blueprint are a number of Major Recommendations. The purpose of this section is to provide a summary of the research and best practices information available to support the recommendations. The major recommendations related to Human Resources, Organizational Development, and Staffing are:

• OD&S-1: Develop Proficiency-based Model for Human Resources Management
• OD&S-2: Implement Web-Based Human Resource Management System
• OD&S-3: Procure Web-based Candidate Management System
• OD&S-4: Analyze IT Role in Organizational Structure
• OD&S-5: Create Web-based IT Staff Development Plans and Programs
• OD&S-6: Enhance District-level Support
• OD&S-7 Analyze School-Level Technical Support

In support of these recommendations, the following information presents current research and best practices for the topics covered in Chapter V --- Human Resources, Organizational Development, and Staffing. To facilitate navigation of the information in this section, the following is a table of contents for this section:

• Proficiency-based Approach to Human Resources Management and Staff Development
  − Framework for Developing a Proficiency-based Model
  − Core Values and Beliefs
  − Mission, Vision, and Goals
  − Key Functions and Tasks
  − Staff Proficiencies
  − Organizational Matrix
  − Job Descriptions/Roles
  − Conceptual Model and Process

• Recruitment, Retention, and Selection
  − Reasons for Shortages
  − Challenges to Recruiting Qualified Teachers in Critical Shortage Areas
  − Recruitment
  − Selection
  − Teacher Selection System
  − Principal Selection System
  − Retention
- Best Practices

- Organizational Development for IT Organizations
  - Analyze ITS Organizational Structure
  - IT Staff Development Planning

- Staffing and Operational, Technical, and End-User Support
  - District- and School-level Support
  - Student Leadership Programs
  - Parent/Community Leadership Program
  - Standards of Service/Service Level Agreements

5.1 Proficiency-based Approach to Human Resources Management and Staff Development

The research and best practice information in the following section supports recommendation OD&S-1: Develop Proficiency-based Model for Human Resources Management

As a result of No Child Left Behind (NCLB), with its strong emphasis on standards, state-wide testing, and accountability, school boards, superintendents, and administrators are pressed to reconstruct a human resources management (HRM) approach that supports and complements:

- important initiatives for students
- measurable standards for performance
- ongoing development and coaching to achieve performance outcomes
- valid assessments of performance linked to identified benchmarks

It is generally recognized that the synergy of staff knowledge, skills, attitudes, and aptitudes (competencies) is an organization’s primary asset, and that this synergy is key to ongoing success and future viability. However, in the educational model, the focus has been more on improving educational tools (curriculum changes, infusion of instructional technology, new program designs) than on aligning and improving staff competencies to enhance student achievement.

To date, HRM systems and processes have not kept pace with contemporary demands. Examples of outdated HRM practices touch all aspects of the human resources function. However, a proficiency-based approach to human resources management will enable M-DCPS to link staff development programs to defined objectives, articulated proficiencies, or supervision/evaluation models; align recruitment and selection practices with required organizational proficiencies and goals; link HRM models to student learning objectives; and create compensation/incentive systems that emphasize the enhancement and
demonstration of specific, job-related knowledge and skills rather than reward longevity, or participation in individual courses.

The functional components of this model include:

- Linkage to Standards, Instruction, and Assessment
- Organizational Unit and Individual Strategic Frameworks
- Required and Current Staff Proficiencies And Levels
- Proficiency-Based Staff Development Programs
- Individual Staff Development Plans
- Supervision and Evaluation
- Links to Personnel and Payroll Management
- Recruitment and Selection

5.1.1 Framework for Developing a Proficiency-based Model

The framework used to develop a proficiency-based model is as follows:

```
Organization’s Mission, Vision, and Goals
  Purpose and Definition for an Organization
  Key Functions of the Organization
  Required Tasks
  Core Proficiencies
    Primary/Secondary Role Proficiencies
    Job Descriptions and Roles
```

5.1.2 Core Values and Beliefs

In order to fulfill any mission effectively, an organization must be grounded in fundamental beliefs and principles. The core values and beliefs of an organization are the underlying support to its mission and strategic aims and, therefore, provide a shared foundation upon which to develop and build a coherent, supportable strategic plan.

To develop a strategic framework for an organizational unit that is consistent with the strategic framework of the Miami-Dade County Public Schools, it is important to begin by reviewing the district's mission, core values and beliefs, and vision. The core values of M-DCPS are:
• **Excellence:** We pursue the highest standards in academic achievement and organizational performance.

• **Integrity:** We build positive relationships through honesty, respect, and compassion, which enhance the self-esteem, safety, and well-being of our students, families, and staff.

• **Equity:** We foster an environment that serves all students and aspires to eliminate the achievement gap.

• **Citizenship:** We honor the diversity of our community by working as a team to ensure the educational success of all of our students and recognize that our obligations go beyond our professional responsibilities to promote democratic principles.

5.1.3 **Mission, Vision, and Goals**

Refer to Chapter I, Vision and Introduction for a complete discussion of the Mission, Vision, and Goals of the Miami-Dade County Public Schools.

5.1.4 **Key Functions and Tasks**

The key functions for an organization are the operational domains within which it operates. A function is a broad division or category of an organization's operation/service which is required to fulfill the organization's mission and vision. The functional tasks are the specific duties required to fulfill the function. Key functions must be aligned with the mission, vision, and goals of M-DCPS.

5.1.5 **Staff Proficiencies**

The synergy of staff knowledge, skills, attitudes, and aptitudes, known as proficiencies, is an organization's primary asset. Proficiencies are the cornerstones of an effective, integrated human resources management structure, in which staff development is a critical building block.

Proficiencies are often grouped into two categories:

- **Core Proficiencies:** general and relevant to most staff (e.g., teamwork, leadership, flexibility, customer-service orientation)

- **Domain/Function-Specific Proficiencies:** necessary to a particular technical, professional, or process area (e.g., role-related technical skills, specific product/service knowledge and skills)

5.1.6 **Organizational Matrix**

Once functions and tasks are defined, functions should be grouped within an organization. Henry Mintzberg in, *Structure in Fives: Designing*
Effective Organizations, lists the following criteria for grouping functions within an organization:

- group by knowledge and skill (e.g., group according to the specialized knowledge and skills that members bring to the job)
- group by work processes and function (e.g., units based on the process or activity performed)
- group by time (e.g., groups formed according to when the work is done)
- group by output (e.g., units are formed on the basis of the products or services they deliver)
- group by clients served

An organizational matrix enables M-DCPS to group staff by both discipline-specific knowledge and professional/technical expertise to meet the objectives of the district's improvement goals. A matrix reporting structure is employed when an organization:

- requires both discipline and function-specific expertise
- requires the ability to adapt to rapid changes in a discipline
- requires shared and flexible use of staff across functions
- is in a complex, rapidly changing environmental domain

5.1.7 Job Descriptions/ Roles

In the traditional form, a job description is often a static document detailing the duties and tasks for a defined role in an organization. In a rapidly changing environment, job descriptions are rigid, ineffective solutions to an elastic problem.

Proficiency-based job descriptions use a job portfolio model to cluster the additional functions, tasks, and proficiencies into logical groupings. The job portfolio is a series of modular, competency- and function-based job matrices that may be combined in different ways to define dynamic organizational roles. Job portfolios are based on the work that needs to be done, the proficiencies required to fulfill the work, and the proficiencies possessed by the organization. The "job description" becomes a "job portfolio," consisting of core functions and proficiencies and domain/function-specific proficiencies.

5.1.8 Conceptual Model and Process

The research and best practice information in the following section supports recommendation OD&S-2: Implement Web-Based Human Resource Management System
Proficiency-based Human Resources Management (HRM)/Staff Development has its foundation in the strategic framework of the organization it supports: its mission, vision, goals, and functions. This conceptual model uses this framework and the education organization’s student learning objectives as the basis for identifying organization-wide required staff proficiencies.

In rethinking staff development, supervision, and evaluation from the proficiency-based perspective, educators have a rich opportunity for reconfiguring standard HRM processes into opportunities for learning. Since, in a continuous improvement cycle, such as the Sterling Model, planning, implementation, and evaluative events are designed to be participatory and ongoing, the HRM functions frame a multi-dimensional process of collective dialogue, learning, and improvement. The paradigm shifts from one of sole accountability to one that recognizes important organizational interdependencies.

A web-based human resource management system centralizes operations while distributing access. Districts should implement a web-based system that supports performance-based pay and a proficiency-based approach to human resource management in order to align performance with the district’s strategic goals and outcomes.

Once function-based proficiencies as well as their associated performance measures and rubrics have been identified, an analysis of acquired versus required proficiencies can be used for effective staff development planning. As with students, staff performance should be evaluated according to multi-level inputs ranging from self-assessment, to

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**Figure 5-1: Model for Using Technology to Develop and Support a Proficiency-based Approach to Staff Development**
peer review, to work portfolios, to dialogues with supervisors and colleagues. Individual staff development plans may be created to address proficiency development needs and, in turn, the outcomes of staff development efforts provide an important and necessary input to the supervision/evaluation process. Because this model is predicated on effective decision support tools, adjustments can be made in real time, with real data, as organizational and individual needs and circumstances require.

To implement this model effectively, it is useful for educators to develop school improvement plans electronically so that information about mission, vision, and goals is readily accessible. Likewise, it is imperative to link the HRM/Staff Development system with an integrated student management and document storage/retrieval system so important student learning data can be accessed, analyzed, and shared readily and efficiently by all staff members. Finally, the successful implementation of this model requires a definition of all key components and an understanding by all staff members about the purpose and desired outcomes of the proficiency-based, HRM/Staff Development approach.

5.2 Recruitment, Retention, and Selection

A shortage of teachers has many states pursuing aggressive measures for recruiting, selecting, and retaining high quality teachers. These shortages have occurred due to increased enrollments, retirements and attrition, and legislation to reduce class sizes and increase student achievement. Shortages are even greater in critical need areas such as mathematics, science, technology, bilingual education, and special education. A comprehensive and multifaceted approach is needed to effectively address the problem.

5.2.1 Reasons for the Shortages

- increased enrollments
- students that have prepared for the classroom but do not accept teaching jobs
- teachers prematurely leaving the profession
- class-size reductions
- inadequate starting salaries
- an aging teaching population

5.2.2 Challenges to recruiting qualified teachers in critical shortage areas

- a lack of students majoring in mathematics, science, technology, and special education
- pressure to hire barely qualified teachers
- pressure to fill open positions with out-of-field teachers
5.2.3 Recruitment

Most states do not have comprehensive teacher recruitment initiatives; local districts generally create and run their own program. Strategies for attracting new teachers include:

**How states are attracting new teachers**
- teaching scholarships and forgivable loans
- alternative certification programs
- reciprocal teaching certification agreements
- support for home loans and relocation expenses
- computers
- professional development opportunities

**How districts are attracting new teachers**
- increasing beginning salaries
- streamline hiring process
- participation in mentoring programs

**How districts are developing the pool of potential teachers**
- enhancing early outreach programs
- developing “Grow Your Own” programs

5.2.4 Selection

Since the mid 1930s, the Gallup Organization has studied human interactions. This knowledge has helped the organization to develop research-based measurement tools, development programs, and strategic advisory services that help organizations and individuals maximize their performance. Individuals and organizations are helped to increase their performance through publications and Gallup’s Virtual University.

**Alternative Certification Programs**

Since the passage of the No Child Left Behind (NCLB) Act, school districts across the country have been hard pressed to meet many of its requirements. One of the chief requirements is that all students in the U.S. school districts be taught by “highly qualified” teachers; with “highly qualified” being indicative of certification in their respected state and
successful completion of the subject matter examination that they plan to teach. The requirement for qualified teachers has increased the shortage of teachers.

State and school districts have implemented alternative certification programs since the early 1980s, to address teacher shortages. By the late 1990s more than 80% of states had established alternative certification programs. The state of Florida mandated in 2002 that all districts establish ACPs or utilize the state's program.

The effectiveness of an alternative certification program (ACP) relies heavily on the admission of quality candidates. Because of the limited number of available slots in a program, selecting the right candidate is critical to the program’s success. The program must have a reliable but fast assessment component, based on solid research.

5.2.5 Teacher Selection System

The research and best practice information in the following sections support recommendation OD&S-3: Procure Web-based Candidate Management System

Teacher Insight is a comprehensive teacher selection and development program. It gives districts a reliable tool to quickly and effectively evaluate a large number of applicants. Newly hired and current teachers can also utilize the program’s development component. The assessment component is the backbone of the system and requires approximately 40 minutes to complete. The assessment is conducted online and the results are quickly made available to the district. Applicant scores are predictive of their success as a teacher based on their talents. The scores can be integrated into the existing applicant tracking system.

Moving to an online application system will eliminate much of the paperwork in the initial stages of the process and streamline the process. Having an online application and selection system will also allow for more readily available applicant information in order to make more informed management decisions.

Additional information about the Teacher Insight system can be found at http://education.gallup.com. Other municipalities, such as, Duval County Public Schools in Florida, Region 13 in Texas, and the Cleveland Municipal School District may be contacted for additional information.

5.2.6 Principal Selection System

Research shows that the key person in school improvement efforts is the principal (Anderson, 1988). Effective communication and interaction is crucial for school success, and the principal’s leadership is the primary
force behind establishing and maintaining these relationships. Therefore, the selection process for principals must yield individuals who are strong in building, nurturing, and fostering interpersonal relationships.

A principal’s impact greatly affects student achievement indirectly, through teachers and other school personnel. A principal’s leadership impacts student achievement through the school’s organization and environment. Principals are responsible for school personnel, climate, plant equipment and supplies, and parental involvement.

The following selection process is based on the Gallup’s Principal Insight system. The system is composed of two components – the Principal Insight and the Clifton Strengths Finder and Discover Your Strengths e-learning tools.

Principal Insight is a web-based instrument that assesses the talents needed to be a successful school principal. Applicant scores are predictive of his/her potential for success as a principal relative to their talents. Scores might be integrated into the districts existing applicant tracking system. Gallup’s consultants are available to assist with implementation. A comprehensive implementation guide and technical support are also available for District staff and applicants.

The Clifton StrengthsFinder and Discover Your Strengths e-learning tool is administered after a candidate has been selected as a principal, vice principal, or other leadership position. The tool is designed to educate the individual and/or their supervisor about their particular talents and how to effectively use them in their leadership position. Supervisors can use this information to provide constructive developmental feedback concerning an individual’s talents. Knowing and understanding the strengths of a principal will enable supervisors to assist aspiring or existing principals in specific ways of improving individual and school site performances. This talent development program can be integrated into the district’s current principal assessment program.

Additional information about the Principal Insight system can be found at http://education.gallup.com

5.2.7 Retention

Recent studies indicate that teacher quality is an important element affecting student achievement. There are an estimated 2.2 million teachers that will be needed over the next decade to teach over 48.1 million students. Selecting, hiring, and retaining quality teachers are critical components of effective school reform.

How states are retaining teachers
- signing bonuses for nationally certified teachers
How districts are retaining teachers

- tuition assistance
- luring retired teachers back to the classroom
- empowering teachers

5.2.8 Best Practices

The following states have instituted state funded programs for developing, recruiting, and retaining teachers that have proven to be successful:

**South Carolina Center for Teacher Recruitment**—is a state funded initiative for increasing the number of teacher candidates. The center conducts career fairs and other programs that promote academic excellence and selecting teaching as a career. The Teacher Cadet Program, Teaching Assistant Program, and the Teaching Fellows Program have shown positive results in placing participants in teaching positions. For more information about the South Carolina’s Center for Educator Recruitment, Retention, & Advancement go to the website: http://www.cerra.org/

**Los Angeles Unified School District’s In-House Teacher Recruitment Program** – in conjunction with the California State University System, the program establishes high school students as para-educators in the school district.

**North Carolina Teaching Fellows Program** – The program was enacted by the North Carolina General Assembly in 1986 with the purpose of recruiting talented high school graduates into the teaching profession and to help them develop leadership skills, such as visionary thinking and risk-taking. Recipients are challenged to see beyond the classroom and to view education as an integral component to quality for life. The program is very successful with graduates having been placed in over 98% of the state’s counties. For more information about the program please go to the website at: http://www.teachingfellows.org/.

5.3 Organizational Development for IT Organizations

5.3.1 Analyze ITS Organizational Structure

The research and best practice information in the following section supports recommendation OD&S-4: Analyze IT Role in Organizational Structure

Many districts are struggling with the role technology will play in enhancing organizational performance. Technology infusion is changing the roles and responsibilities for chief executive officers, superintendents,
principals, administrative staff, classroom teachers, and clerical/support staff. These changes have a profound impact on both staffing and organizational structure. Placing the appropriate number of people with the right skills, knowledge, and experience in the right places with the right tools, resources, and training is key to the success of the ongoing operation and management of a comprehensive information technology system.

Figure 5-2 below provides a proposed organizational structure that, when fully implemented and managed, will greatly assist the district in successfully implementing all of the proposed recommendations and implementation approaches contained within this Information Technology Blueprint/Plan.

Conceptual/Proposed Organizational Structure for Information Technology Services

Note: The organizational structure provided has been designed to support the M-DCPS' Comprehensive Information Technology Blueprint. As the Blueprint evolves and is implemented over time, so must the proposed organizational structure.

* See Appendix (Matrix outlining ITS customer service staff assigned by software application and district office/function)

Figure 5-2: Proposed Organizational Structure for Information Technology Services

The active participation of the executive leadership team is an important factor for successful integration of technology in schools. The graphic above illustrates an efficient and effective structure for communication and workflow as well as ongoing management review at all levels. In addition, the use of outside contractors to act as the district's IT architect...
and systems integrator will allow district staff to remain focused on improving student achievement rather than on technical or operational issues. This type of approach provides the school district and its constituents an adequate level of checks and balances among client (schools), architect, and provider (ITS). It also creates a high level of intellectual synergy and a wealth of past experiences that can be drawn upon to solve problems quickly and systemically with a high degree of quality assurance.

Using the proficiency-based approach to human resources management that was outlined in 5.1 of this document, the district should go through the following steps to refine the above-mentioned organizational structure:

- review the current organizational structure of ITS
- examine the mission, vision, and strategic goals.
- identify additional organizational and staffing needs.
- update/add key functions and tasks.
- determine the staff proficiencies/proficiencies required to perform functional requirements
- identify performance measures for each staff competency/proficiency.
- align/cluster staff proficiencies/proficiencies into job descriptions with related roles/responsibilities.
- align revised job descriptions with M-DCPS’ supervision and evaluation process.
- update the organization chart and reporting relationships.
- conduct retreat to review the proposed organization structure, key functions, tasks, and proficiencies.
- refine organization structure and job descriptions

5.3.2 IT Staff Development Planning

The research and best practice information in the following section supports recommendation OD&S-5: Create Web-based IT Staff Development Plans and Programs

The new organizational model will drive the need to upgrade existing staff skills or hire new staff who have the skills to support new functions. Thus, M-DCPS should develop an IT staff development program that aligns and manages staff proficiencies and staff development initiatives with organizational improvement goals. IT staff members should have individual plans that are closely tied to revised job descriptions. The district must provide the resources for developing the proficiencies
required for new positions in current staff and broker staff development programs to enable staff to increase their core and domain/function-specific proficiencies. Refer to Blueprint Chapter VI: Staff Development for a more in depth description of staff development plans.

5.4 Staffing for Operational, Technical, and End-User Support

5.4.1 District- and School-level Support

The research and best practice information in the following section supports recommendations OD&S-6: Enhance District-level Support and OD&S-7: Analyze School-level Technical Support.

Historically, M-DCPS, like most other educational organizations, has responded to technological innovations in the classroom by creating support positions. For example, the printing press spawned the creation of librarians, Sputnik was the catalyst for acquiring media coordinators, and the critical need for mainframe applications such as student information systems was the impetus behind most districts adding the position of data entry clerks to its cadre of school employees. This type of position layering will cease and a total overhaul and re-analysis of the district- and school-level technology staff will be required by district leadership.

What is clearly needed beyond the systems integration and daily operational and support functions is technical assistance targeted to address building-level needs. Figure 5.3 below suggests that some school-level assistance be forthcoming in the position of the Coordinator of Information and Technology and with the remainder provided regionally through an information and technology support team located at the regional superintendent’s office.
Each school will achieve the staffing/support levels necessary to provide a reasonable degree of autonomy, while at the same time ensuring that all students/staff are provided equitable technology support. Each school will have the role of Coordinator of Information and Technology to lead and support the information and technology resources and activities. Appendix C provides a sample proficiency-based job description for this position.

As noted, several of the functions outlined in Figure 5-3 above may not require a full-time equivalency. When that occurs there are two options. The first option is to have a person within the building develop skills in a number of the areas such that they may provide a broad range of services required. This option works best in such roles as library aide, media aide, and data entry support where the skills and knowledge required can easily be gained. The other option is to share and manage the resource requirements across a region. This option is more appropriate for positions requiring deeper technical or professional
knowledge and skills. Positions in this category include network management, professional development, and information access and analysis.

The tables in Appendix B represent the recommended staffing levels required to support effective use of education technology. The implementation planning at the local level will need to address how schools transition from their present staffing levels to the optimum functional levels recommended.

An important and valuable asset in any school system is the knowledge of the students, their parents, and the people in the community. The Coordinator of Information and Technology will work with school leadership to organize and manage student technology leadership programs. The goals of these programs are threefold:

- to provide support for the classroom teachers and clerical staff in the use of new technologies
- to recognize and appreciate the value of the resources in the community
- to reduce costs

5.4.2 Student Leadership Programs

The student technology leadership program will identify, recognize, and use the skills and knowledge of students to assist other students, classroom teachers, and clerical staff in using technology. In addition to assisting the teachers, the student participants will continue to develop their own skills and abilities in existing and new/emerging technologies.

The Youth Technology Support Collaborative (YTSC) was established during the summer of 2003 by a coalition of nonprofits, associations and companies (e.g., CoSN - the Consortium for School Networking), MOUSE - Making Opportunities for Upgrading Schools and Education, and Apple). YTSC includes 20 non-profit organizations, technology companies and professional associations that promote informed and meaningful roles for youth as technology leaders in their school communities.

A recent Florida state study of technology in instruction suggested that an effective student help program was an important part of the first tier of support for users. The Apple Help Desk, Generation TECH, or other sole source models could provide options to assist secondary schools in supporting equipment in their school and others, while offering students valuable skills for the workplace.

Gen TECH

Gen TECH is another student-powered support program. Generation TECH was designed for schools and incorporates the kind of pedagogy needed to run student technology-support programs. Its curriculum and
resources address all hardware platforms. For multiple platforms, GenTECH has a robust set of online tools that gives each student a login account to create projects, keep journals, and link to the resources they build. GenTECH also provides the teacher with his/her own login so that he/she can view a class management page, edit, and respond to student work on-line. This gives the teacher many alternatives to assess student work.

**Youth Tech Entrepreneurs (YTE)**

YTE develops student leaders who use their academic, information technology, and business skills to build stronger communities. It provides schools and communities with an innovative, curriculum and project-based approach that equips diverse students with the professional, technical, and leadership skills to succeed in tomorrow’s economy. YTE’s coursework, service projects, programs and competitions enable students to identify and address local needs through technology. By bringing together students, educators, community and business leaders, YTE strengthens communities and develops tomorrow’s leaders today.

**MOUSE**

MOUSE - Making Opportunities for Upgrading Schools & Education was founded in 1997 to be a catalyst for the integration of technology and learning in public schools by empowering students and schools to succeed in the Information Age. MOUSE’s primary initiatives are MOUSE Squad, a student-driven program to address technology needs of elementary, middle, and high schools and TechSource, a comprehensive information and research program that will provide an accurate, overall picture that describes how teachers and students are using technology in schools across New York City.

**Other Models**

Other models for students helping teachers in the area of technology integration in classrooms include:

- Ohio SchoolNet’s ASSIST project (All Student System Interns Supporting Technology) is studying 30 successful, field-proven models of technology support that include student involvement. Districts not currently using students as resources to support technology integration are encouraged to review the information on the SchoolNet Website and consider piloting the model that best addresses their local needs. [www.osn.state.oh.us./misc/assist/index.asp?p=1&text=0](http://www.osn.state.oh.us./misc/assist/index.asp?p=1&text=0)

- Out 2 Teach ([www.out2teach.com](http://www.out2teach.com)), much like Generation Y, a nationally recognized student technology leadership program originating in Olympia, Washington, helps establish a starting
point for teachers who want to integrate technology into their lesson plans. Students are engaged in building educational resources incorporating links to be used in the classroom and content to place on educational websites.

5.4.3 Parent/Community Leadership Program

The parent/community technology leadership program will tap into the valuable knowledge and professional skills available in the community. The program members can assist with such things as developing school-level technology plans, mentoring, building wiring, application training, and system management. The collaboration fostered through this program of interaction and support will provide faster, more effective uses of existing and emerging technologies at reduced costs. It will also create a closer link between the schools and the communities they serve.

5.4.4 Standards of Service/Service Level Agreements

Standards of Service or Service Level Agreements are commonly used in the information technology industry to provide benchmarks for service and to help organizations set goals for improvement. Initially, they will be established on major applications with the widest impact on district users (e.g., Internet response time from schools and departments, student information system, ERP, etc.). An SLA for each of these applications includes a monitoring capability, customer agreement, and targets for continuous improvement. Service level agreements for these key services can be followed in other areas as deemed most appropriate. Technology leadership will 1) monitor the service to show trends over time, 2) document agreements with customers, and 3) develop a continuous improvement plan to ensure improved service.

In an effort to achieve higher standards of service with new critical applications, an ITS liaison should be part of the life cycle process from inception through installation and deployment. ITS has been extremely willing to provide the liaisons; however, district departments must be made aware that they cannot procure systems without ITS involvement from the beginning of the project.
6.0 STAFF DEVELOPMENT

Included in the Technology Blueprint are a number of Major Recommendations. The purpose of this section is to provide a summary of the research and best practices information available to support those recommendations. The major recommendations related to Staff Development are:

- SDV-1: Add Technology Proficiencies to Proficiency-Based Job Descriptions
- SVD-2: Proficiency-based Professional Development Program
- SDV-3: Centralized Staff Development Activities Listing
- SDV-4: EETT Technology Leadership Program Expansion

In support of these recommendations, the following information presents current research and best practices for the topics covered in Chapter VI—Staff Development. To facilitate navigation of the information in this section, the following is a table of contents for this section:

- Staff Technology Proficiencies
  - K-12 Teachers
  - Administrators
  - School and District Technology Leaders
  - Staff Developers
  - Technical Support Staff
- Staff Development Planning and Delivery
  - Effective Staff Development Strategies
  - Attributes of Successful Technology Staff Development
  - Staff Development Delivery Methods
- Staff Development Programs
  - Staff Development Providers
  - Institutes for Higher Education
  - Commercial Providers/Vendors/Consultants
  - Online Service (Free and Subscription-based)
  - Professional Societies

According to Peter Senge, continuous learning is the basis of sustainable growth and organizational success. Staff development is the formal process by which an organization cultivates and nurtures the continuous learning and improvement of its personnel. As organizations move away from a focus on training to a focus on improving performance, they require a systematic way to align performance with strategic outcomes and goals, the most critical of which in education is improved student learning. This section outlines the critical components of a proficiency-based approach to staff development which aligns staff performance with strategic outcomes and goals.
The synergy of staff knowledge, skills, attitudes, and aptitudes, known as proficiencies, is an organization’s primary asset. Proficiencies are the cornerstones of an effective, integrated human resources management structure in which staff development is a critical building block.

The proficiency-based approach to staff development is based upon three core beliefs:

- Every adult has the capacity to be a self-directed, lifelong learner when provided with quality development information and resources.
- Every adult has the capacity to design and implement effective individual development plans that address growth and improvement priorities that are aligned with district and department/school strategic goals.
- Continual, systemic improvement is directly linked to the ongoing learning of all individuals and groups and is focused on strategic, high-leverage priorities of the district, department/school, team, and individual.

The vision of the proficiency-based technology professional development system is to identify individual knowledge gaps and provide targeted professional development workshops to raise the technology competency and curriculum integration skills of all teachers. The goals of the system are to:

- develop a modular e-learning program targeting clusters of technology-related issues
- create an efficient professional development system so that teachers get the maximum benefit from training time
- institute a data-driven assessment tool so that teachers can identify their individual technology strengths and weaknesses
- teach technical skills in context whenever possible so that teachers view technology as an instructional tool rather than an entertainment option

By using a train-the-trainer model, district personnel will be able to initiate self-assessments, oversee professional development plans, and monitor online training. Mentoring groups will provide additional support for teachers learning new skills.

The key functions of a proficiency-based professional development system are to define a self-assessment tool for a needs analysis, develop a format for an individual professional development plan, and provide targeted training to address the gaps in proficiency. Proficiency-based staff development has its foundation in the strategic framework of the organization it supports: its mission, vision, goals, and functions. Proficiencies are the combination of observable and measurable skills, knowledge, and personal attributes that contribute to enhanced staff performance and organizational success. Proficiencies are often grouped into two categories:

- Core Proficiencies: general and relevant to most staff (e.g., teamwork, leadership, flexibility, customer-service orientation)
- Domain/Function-Specific Proficiencies: necessary to a particular technical, professional, or process area (e.g., role-related technical skills, specific product/service knowledge and skills)
This conceptual model uses this framework and the education organization’s student learning objectives as the basis for identifying required staff proficiencies organization-wide.

Comprehensive strategic staff development planning involves six phases comprised of planning tasks within each phase. Establishing a comprehensive, integrated plan for staff development will provide the framework and strategic direction critical for:

- creating development activities that are results-driven and focused on improved student learning
- aligning staff development programs, delivery strategies and models, structures, and interventions with district and staff improvement goals and functional role requirements
- developing the structures and processes for self-directed, lifelong learning
- linking staff development outcomes with the supervision and evaluation of staff performance
- providing a shared learning model and pedagogic framework for all learners in the organization
- using the power of technology to improve the delivery, monitoring/evaluation, and management of staff development programs
- maximizing the impact of limited staff development dollars (return on investment)

Topics in this section include:

- Staff Technology Proficiencies
- Staff Development Planning and Delivery
- Staff Development Programs

In addition to nationally researched approaches, the current work of the M-DCPS and the state of Florida are reflected in this body of knowledge.

### 6.1 Staff Technology Proficiencies

The research and best practice information in the following section supports recommendation SDV-1: Add Technology Proficiencies to Proficiency-Based Job Descriptions.

In order to address the staff development and training needs of all personnel working in education comprehensively, it is necessary to describe the unique needs associated with each constituent group. Technology skills, knowledge, and attitudes need to be encouraged, demonstrated, and assimilated by K-12 teachers, administrators, support staff, information technology facilitators, education technology directors, and school board members.
6.1.1 **K-12 Teachers**

Students, teachers, and administrators use technology in different ways. While all may use word processing tools in some way, the specific needs and skills are differentiated by the tasks at hand and to some extent by the age of the user. In addition, a person with specific technology-related assignments at a school site needs to know and be able to do far more than the average teacher.

In 2000, the International Society for Technology in Education (ISTE), recognizing that there is a core set of knowledge with differentiated pathways for different and interacting audiences, released the National Education Technology Standards for Teachers (NETS•T). ISTE also designed standards for students and administrators. The NETS Standards can be found at [http://www.iste.org/standards/index.cfm](http://www.iste.org/standards/index.cfm).

According to ISTE, Educational Computing and Technology (ECT) is an emerging field which encompasses many sub-disciplines. This field includes knowledge about and use of computers and related technologies in:

- integration of technology and curriculum to support learning
- delivery, development, prescription, and assessment of instruction
- effective use of computers as an aid to problem solving
- school and classroom management
- educational research
- electronic information access and exchange
- personal and professional productivity
- technical assistance and leadership
- computer science education

**NETS•T**

The broad areas of the NETS standards for teachers include:

I. Technology Operations and Concepts
II. Planning and Designing Learning Environments and Experiences
III. Teaching, Learning and the Curriculum
IV. Assessment and the Evaluation
V. Productivity and Professional Practice
VI. Social, Ethical, Legal and Human Issues

The full description of the standards can be found at: [http://cnets.iste.org/getdocs.html](http://cnets.iste.org/getdocs.html).
ISTE: First-year Teaching Performance Profile

In Florida, first-year teachers must demonstrate accomplished practices during their initial year of teaching, including use of technology in instruction. The NETS-T recommendations for first-year teachers are tied to the standards category to which the performance is linked.

Upon completion of the first year of teaching, teachers must be able to do the following:

• assess the availability of technology resources at the school site, plan activities that integrate available resources, and develop a method for obtaining the additional necessary software and hardware to support the specific learning needs of students in the classroom (NETS-T standards I, II, IV)

• make appropriate choices about technology systems, resources, and services that are aligned with district and state standards (NETS-T standards I, II)

• arrange equitable access to appropriate technology resources that enable students to engage successfully in learning activities across subject/content areas and grade levels (NETS-T standards II, III, VI)

• engage in ongoing planning of lesson sequences that effectively integrate technology resources and are consistent with current best practices for integrating the learning of subject matter and student technology standards (as defined in the ISTE National Educational Technology Standards for Students) (NETS-T standards II, III)

• plan and implement technology-based learning activities that promote student engagement in analysis, synthesis, interpretation, and creation of original products (NETS-T standards II, III)

• plan for, implement, and evaluate the management of student use of technology resources as part of classroom operations and in specialized instructional situations (NETS-T standards I, II, III, IV)

• implement a variety of instructional technology and grouping strategies (e.g., whole group, collaborative, individualized, and learner centered) that include appropriate embedded assessment for meeting the diverse needs of learners (NETS-T standards III, IV)

• facilitate student access to school and community resources that provide technological and discipline-specific expertise (NETS-T standard III)

• teach students the methods and strategies to assess the validity and reliability of information gathered through technological means (NETS-T standards II, IV)

• recognize students’ talents in the use of technology and provide them with opportunities to share their expertise with their teachers, peers, and others (NETS-T standards II, III, V)
• guide students in applying self- and peer-assessment tools to critique student-created technology products and the process used to create those products (NETS-T standard IV)

• facilitate students’ use of technology that addresses their social needs and cultural identity and promotes their interaction with the global community (NETS-T standards III, VI)

• use results from assessment measures (e.g., learner profiles, computer-based testing, electronic portfolios) to improve instructional planning, management, and implementation of learning strategies (NETS-T standards II, IV)

• use technology tools to collect, analyze, interpret, represent, and communicate data (student performance and other information) for the purpose of instructional planning and school improvement (NETS-T standard IV)

• use technology resources to facilitate communications with parents or guardians of students (NETS-T standard V)

• identify capabilities and limitations of current and emerging technology resources and assess the potential of these systems and services to address personal needs, lifelong learning, and workplace needs (NETS-T standards I, IV, V)

• participate in technology-based collaboration as part of continual and comprehensive professional growth to stay abreast of new and emerging technology resources that support enhanced learning for pre-K-12 students (NETS-T standard V)

• demonstrate and advocate for legal and ethical behaviors among students, colleagues, and community members regarding the use of technology and information (NETS-T standards V, VI)

• enforce classroom procedures that guide students’ safe and healthy use of technology and that comply with legal and professional responsibilities for students needing assistive technologies (NETS-T standard VI)

• advocate for equal access to technology for all students in their schools, communities, and homes (NETS-T standard VI)

• implement procedures consistent with district and school policies that protect the privacy and security of student data and information (NETS-T standard VI)

**Florida Educator Accomplished Practice #12: Technology**

The Florida Standards Commission developed a set of standards for educators called the Florida Accomplished Practices [http://www.firn.edu/doe/dpe/publications/accomplished4-99.pdf](http://www.firn.edu/doe/dpe/publications/accomplished4-99.pdf). Practice #12 includes a set of “proficiencies for teachers of the 21st century” that are aligned to NETS•T. An accomplished practitioner:

• teaches technology literacy at the appropriate skill levels
• evaluates and implements technology tools that enhance learning opportunities which are aligned with Sunshine State Standards and meet the needs of all learners
• teaches legal and ethical uses of technology
• evaluates and uses a wide range of instructional technologies (e.g., CDROM, interactive video, videotaping, and electronic libraries) to enhance the subject matter, assure it is comprehensible to all students, and develop higher order thinking skills
• uses technology to construct a variety of teaching materials and assessment exercises and applies current research on integrating technology when planning for instruction
• makes classroom management decisions based on data derived from the use of technology productivity tools and monitors student learning in a technology-enhanced environment
• facilitates student learning of technology as it relates to curricular activities
• facilitates and learns along with the students, empowering all students to become independent learners in a technology-rich, learner-centered environment
• analyzes and evaluates the effectiveness of educational software tools on student learning
• develops and publishes digital content and provides students with opportunities to gather and share digital information through intranets and/or the Internet
• collaborates via technology beyond the boundaries of the school to support learning
• incorporates technology integration goals in a professional development plan as addressed in the school improvement plan
• uses accessible and assistive technology to provide curriculum access to those students who need additional support to access physically or cognitively the information provided in the general education curriculum at each school site

**NCLB Requirements for the Highly Qualified Teacher**

The No Child Left Behind legislation focuses on ways teachers and students can use technology. Previous federal programs focused on increasing access to more technology. In an effort to improve student achievement, the U.S. Secretary of Education announced a new Enhancing Education through Technology (ED Tech) initiative. The goals of this initiative are to:

• improve student academic achievement through the use of technology in elementary schools and secondary schools
• assist students to become technologically literate by the time they finish the eighth grade
• ensure that teachers are able to integrate technology into the curriculum to improve student achievement

The Instructional Technology Planning Document, developed by the Digital Natives Committee, is aligned with NCLB mandates for qualified teachers.

6.1.2 Administrators

In order for technology to be successfully integrated into the teaching, learning, and management processes, district-, area-, and school-level administrators must demonstrate leadership and model appropriate behavior. According to The Collaborative for Technology Standards for School Administrators (TSSA Collaborative), “the effective 21st Century administrator is a hands-on user of technology. Much of the benefit of technology is lost for administrators who rely on an intermediary to do their e-mail, manipulate critical data, or handle other technology tasks for them.” The district has adopted the National Education Standards for Administrators (NETS•A) developed by TSSA as a component of the NETS project as well as the National Education Technology Standards for Administrators (NETS•A) developed by TASS as a component of the NETS project.

NETS•A

The primary goal of the ISTE NETS project is to enable stakeholders in pre-K-12 education to develop national standards for educational uses of technology that facilitate school improvement in the United States.

The National Educational Technology Standards for Administrators (NETS•A), developed through the Technology Standards for School Administrators (TSSA) Collaborative, identifies knowledge and skills constituting the "core" of what every pre-K-12 administrator needs to know about and be able to do with technology, regardless of specific job role. ISTE has embraced the TSSA standards as the national standards and extended the "core" skills and knowledge to include the specific provisions for administrators in three job roles:

• superintendent and executive cabinet
• district-level leaders for content-specific or other district programs
• campus-level leaders, including principals and assistant principals.

An underlying assumption of these standards is that administrators should be competent users of information and technology tools common to information-age professionals.
The Collaborative for Technology Standards for School Administrators (TSSA Collaborative) has developed a set of standards for which administrators should "know and be able to do to optimize the effective use of technology." TSSA includes standards for superintendents, district program directors, and principals. The following outlines the six high-level categories. For a description of role-specific technology leadership tasks and performance indicators, please refer to: http://cnets.iste.org/tssa/

I. Leadership and Vision—Educational leaders inspire a shared vision for comprehensive integration of technology and foster an environment and culture conducive to the realization of that vision.

II. Teaching and Learning—Educational leaders ensure that curricular design, instructional strategies, and learning environments integrate appropriate technologies to maximize learning and teaching.

III. Productivity and Professional Practice—Educational leaders apply technology to enhance their professional practice and to increase their own productivity and that of others.

IV. Support, Management, and Operations—Educational leaders ensure the integration of technology to support productive systems for learning and administration.

V. Assessment and Evaluation—Educational leaders use technology to plan and implement comprehensive systems of effective assessment evaluation.

VI. Social, Legal, and Ethical Issues—Educational leaders understand the social, legal, and ethical issues related to technology and model responsible decision-making related to these issues.

FloridaLeaders.net
http://www.floridaleaders.net/agtl

Working with local school districts, the Florida Leaders.net Regional Institutes provide principals with hands-on practical training and online support to assist them in including technology into their school improvement planning process and in modeling effective uses of technology as school leaders.

A statewide network of Certified Master Trainers has provided the Florida Leaders.net Institute curriculum to more than 3,000 school leaders throughout the state on a regional basis during the past three years. A component of Florida Leaders.net has been a network of retired principals providing one-on-one coaching and mentoring support statewide to Florida's principals. Funded by the Bill and Melinda Gates Foundation, the program was administered by the Miami Museum of Science and ended in June 2004.
Florida Leaders.net has partnered with A.E.L. to provide nine online courses for all participating Florida school administrators. These free courses provide in-depth learning in technology leadership, ongoing support to improve leadership skills, and opportunities to apply for in-service credit through the school district. All school administrators at participating Florida Leaders.net schools are eligible to register and complete AGTL courses. Each course module requires about six-to-eight hours to finish.

The course content includes:

- creating and articulating a clear vision of technology integration for a school community
- discovering practical approaches for developing and implementing successful technology planning, including a budget reflecting total cost of ownership for technology
- using technology to strengthen existing community relationships and build new ones
- developing an effective professional development plan for technology to support curriculum-based integration practices
- implementing innovative strategies for promoting the effective integration of technology throughout the teaching and learning environment
- increasing access to educational technologies within and beyond the school
- providing support, both pedagogical and technical, to increase the return on a school’s technology investment
- using technology for student assessment and evaluation of the impact of technology initiatives
- understanding ethical and legal concerns educators face when using technology throughout the teaching and learning environment

Florida Leaders.net also partnered with Palm, Inc. to provide Palm Certified Educational Training Coordinators to assist districts and schools with the integration of hand-held computer technology into administrative and educational practice.

6.1.3 School and District Technology Leaders

ISTE and NCATE have jointly developed standards for building-level technology facilitators and leaders. These programs prepare teachers for an add-on endorsement to an existing teaching certificate.
**ISTE: Technology Facilitation (TF)**

Technology Facilitation (TF) endorsement programs meeting ISTE standards prepare candidates to serve as building/campus-level technology facilitators. Candidates completing this program will exhibit knowledge, skills, and dispositions equipping them to teach technology applications; demonstrate effective use of technology to support student learning of content; and provide professional development, mentoring, and basic technical assistance for other teachers who require support in their efforts to apply technology to support student learning.

The TF program standards are aligned with the six National Educational Technology Standards for Teachers, but extend the performance expectations of each candidate to reflect preparation for serving as mentor, coordinator, or technology integration specialist, assisting the teachers in their efforts to support student learning and professional growth with technology. (Revised Fall 2001)

**ISTE: Technology Leadership (TL)**

Technology Leadership (TL) advanced programs meeting ISTE standards prepare candidates to serve as technology directors, coordinators, or specialists. Special preparation in computing systems, facilities planning and management, instructional program development, staff development, and other advanced applications of technology to support student learning and assessment will prepare candidates to serve in technology-related leadership positions at district, regional, and/or state levels.

The TL program standards are aligned with the six NETS for Teachers, but extend the performance expectations of each standard to reflect preparation for serving as a director, coordinator, or technology integration specialist at the district, regional, and/or state levels, assisting teachers as well as technology facilitators in their efforts to support student learning and educator professional growth with technology.

### 6.1.4 Staff Developers

The National Staff Development Council (NSDC) has revised its standards for professional development. Working with 22 other education organizations, NSDC has concluded, “Staff development must be results-driven, standards-based, and job-embedded.”

The National Staff Development Council has developed a set of standards for staff developers. These standards provide “direction for designing a professional development experience that ensures educators acquire the necessary knowledge and skills.” The NSDC advocates that

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staff development be “results-driven, standards-based, and job-embedded.” For more information about the standards see http://www.nsdc.org.

6.1.5 Technical Support Staff

Support staff plays an integral role in the effective operations and management of the educational process. Their involvement spans numerous roles, all essential for effective day-to-day operation of districts, schools, and classrooms. These roles include:

- clerical support at the district and school office
- classroom or computer lab paraprofessionals
- cafeteria and food preparation workers
- school transportation employees
- maintenance staff

The training of this population of school employees greatly enhances school operations by allowing them to carry out their duties effectively.

Under the No Child Left Behind legislation, paraprofessionals working in Title I schools whose duties include instructional support and who were hired after January 8, 2002, must have: (1) completed two years of study at an institution of higher education; (2) obtained an associate’s (or higher) degree; or, (3) met a rigorous standard of quality and be able to demonstrate, through a formal state or local academic assessment, knowledge of and the ability to assist in instructing reading, writing, and mathematics (or, as appropriate, reading readiness, writing readiness, and mathematics readiness). The paraprofessional assessment is expected to evaluate paraprofessional candidates at a level equivalent to the second year of college.

6.2 Staff Development Planning and Delivery

Staff development planning and delivery are key components to successful school reform. School districts across the country are continuously struggling with the ever-increasing need for professional development and the inability to efficiently and effectively plan and deliver the necessary programs. Staffing schools with qualified teachers is further complicated by high departure rates among new teachers, as well as federal guidelines in the No Child Left Behind Act, calling for the management of teacher qualification.
6.2.1 Effective Staff Development Strategies

The research and best practice information in the following section supports recommendation SDV-3: Centralized Staff Development Activities Listing.

Staff development related to computer technology skills and potential applications in the classroom will result in learning outcomes that evolve to meet the needs of educators and their students.

Staff development has no meaning unless one accepts the assumption that educators can and will continue to develop their skills and proficiencies beyond those demonstrated at the start of employment. People cannot survive in rapidly changing organizations if they are not provided with new learning experiences.

Because staff development is geared to an adult audience, here are some things to consider when providing staff development:

**Principles:**

- Adult learning programs should capitalize on the experience of participants.
- Adult learning programs should adapt to the aging limitations of the participants.
- Adults should be challenged to move to increasingly advanced stages of personal development.
- Adults should have as much choice as possible in the availability and organization of learning programs.

The National School Boards Association suggests that successful staff development will be:

- planned by staff groups that include representatives of all stakeholders in school change
- task-specific, focusing on actual uses of technology that will serve curricular or administrative goals, including those identified by a staff needs assessment
- led by staff members who use the technology in question for the same purposes as will the colleagues whom they instruct and who are proficient in teaching adults and in modeling effective teaching strategies
- adequate in the time it allows for teachers to learn, practice, and apply new concepts and techniques
offered to staff members who have access to hardware and software they can practice with in their classrooms or offices during in-service training

- sensitive to staff members’ personal needs and schedules, offering credit, stipends, and/or release time

- flexible in allowing teachers to use what they learn in a variety of ways appropriate to their individual situations

- supported by handouts that spare trainees from having to take copious notes and that trainees can use to support lessons in their classrooms

- appropriate to staff members’ current attitudes and expertise

- supported at the building and district levels with adequate, ongoing staff and time for person-to-person and small group instruction

- accepted throughout the school community as an ongoing activity, not a single event

- continuously evaluated and improved

6.2.2 Attributes of Successful Technology Staff Development

The integration of new strategies and/or tools into any learning environment requires the inclusion of staff development to ensure successful results. In the area of technology and curriculum integration, the staff development offered has a direct impact on the success of implementation. These development opportunities will address the following areas:

- technical understanding of the use of the application and/or device. For example, what are the primary features of a particular software application or how does one use a new device such as a digital camera, data projector, or hand-held computer?

- pedagogical understanding of when and how to integrate the new strategy or device into a content area in order to address content standards

- practical understanding of the use of the strategy or device to make the management of one’s work easier

- knowledge of ways to manage proper use and care of the application and/or device to ensure that it stays in good condition for the next user

M-DCPS currently offers a wide array of staff development strategies and opportunities for administrators, educators, and support staff. The following list presents a sample of the existing staff development strategies to support curriculum and technology integration:

- Virtual New Teacher Center

- Summer Heat: Institutes for Leadership Teams and Teachers
Coaching Academy
Stellar Support Teams
Higher Education Consortia
Stellar Center for Teaching and Learning
Enhancing Education Through Technology – (EETT)

M-DCPS continues its approach to integrating technology into teaching, learning, and management, to ensure successful results.

6.2.3 Staff Development Delivery Methods

Miami-Dade County Public Schools currently have a variety of staff development delivery models in place: Webcast, online learning, one-day workshops, mentoring, courses through local colleges, and an extensive summer program. “Summer Heat” offers an assortment of workshops ranging from two days to two weeks covering a variety of curriculum and class management topics. The Leadership Development section includes a mandatory principal’s conference and several leadership workshops.

The methods in which technology staff development and training are delivered vary in their approach and desired outcome. Each staff development and training session should be structured and customized to meet the needs, skill level, and interests of its target audience, addressing what can be accomplished given the computer technology resources available. Sample modes of instruction that could be utilized for staff development and training in technology use include:

- group instruction with trainer
- individual learning modules for in- or out-of-class work
- individual opportunities to experiment or "play" with the computer in a private setting
- hands-on activities with trainer support
- partner or peer support to increase collaborative efforts and support
- games or simulations incorporated into technology training to increase participant interest
- online learning
- instruction modules on video
- interactive CD
- Webinars
- videoconferencing
- coaching
- mentor/mentoree relationships
Staff development and training can capitalize on the expansion of the technology field to provide the most advanced, participant-oriented learning opportunities possible.

6.3 **Staff Development Programs**

The research and best practice information in the following section supports recommendation SDV-4: EETT Technology Leadership Program Expansion.

The overall goal and purpose of professional development programs is to increase the knowledge base of workers and employee productivity. Planners of professional development must recognize that change is fluid. That is, change in worker behavior will more likely occur if professional development is well planned and systematic over time. Change will not occur in a "one-shot" or "band-aid" approach to any professional development activities.

6.3.1 **Staff Development Providers**

Staff development (SD) is the term educators use to describe the continuing education of teachers, administrators, and other school employees. Teachers need and receive a wide variety of staff development opportunities. In-service education, teacher training, staff development, professional development, and human resource development are terms that are often used interchangeably. Attending classes, workshops, or conferences is one way that teachers, and other school employees, learn some of what they need to know. But other types of staff development are just as important and are often more effective than traditional sit-and-get sessions. Distance learning, online learning, and interactive CD’s are some of the other types of delivery methods.

Staff development leaders are individuals within a school or other educational organization who plan, coordinate, implement, and/or evaluate staff development programs. SD Leaders include, but are not limited to, directors of staff development, superintendents, school board members, principals, curriculum coordinators, and lead teachers.

Staff development providers use their knowledge and skills to promote and encourage adult learning and to help groups and organizations to perform more effectively. SD providers include, but are not limited to, trainers, facilitators, consultants, mentors, and instructional and leadership coaches.

6.3.2 **Institutes for Higher Education**

Partnerships with local colleges and universities provide a valuable academic support system for teachers, administrators, and non-instructional personnel as well as students.
South Florida has a wealth of institutions of higher education. Universities, Colleges, and other organizations include:

- Annenberg Foundation
- Barry University
- Broward Community College
- Florida Atlantic University
- Florida International University
- Florida Memorial University
- Lynn University
- Miami-Dade College
- Nova Southeastern University
- St. Thomas University
- University of Miami

6.3.3 Commercial Providers/Vendors/Consultants

Since 1994, Classroom Connect has been helping teachers use technology to improve learning. The company's professional development programs and online instructional materials target the changing needs of K-12 school districts. Classroom Connect is part of Harcourt Education, a global education provider serving students and teachers in pre-K through grade 12, adult learners, and readers of all ages.

Connected University is an online professional development resource providing educators with courses, learning resources, just-in-time support, and a nationwide community of peers seeking to integrate technology and improve student learning in schools.

Learners can choose from software tutorials, how-to tips, and dozens of guide-led and self-paced courses. Many courses are available for graduate credit and continuing education units.

Connected University has four departments offering courses in these areas of study:

- technology Integration
- mathematics
- educational Leadership
- curriculum and Instruction
For those who prefer face-to-face learning, Connected Workshops are single- or multi-day staff development experiences designed to help teachers have an impact on student achievement. More than 50 workshop titles are available in these five areas:

- reading
- mathematics
- technology integration
- educational leadership
- curriculum and instruction

6.3.4 Online Service (Free and Subscription-based)

*Microsoft Online Tutorials*


Microsoft’s education Web site offers information, tutorials, clip art, templates, and other materials for both K-12 and higher education faculty and students. The tutorials cover ways to use and integrate Microsoft software for both Windows and Macintosh platforms in the classroom with in-depth, step-by-step guides for students, teachers, and staff. Some of the tutorials offer chapters from books that can be downloaded for later searching and reading. In addition, there is a “Teaching and Learning” CD with education templates and clip art, but the same content can also be downloaded from the education site for free. The templates for the Office family are installed as new tabs and templates, adding education-appropriate content and images to the existing Word, PowerPoint, and Excel content.

*Edutopia*

[http://www.edutopia.org](http://www.edutopia.org)

"Edutopia" is a vision of powerful teaching and learning. The good news is that the vision is being realized today in our nation's best schools. In an ideal educational landscape, students are motivated to learn and teachers are energized by the excitement of teaching. In these schools, parents/caregivers and other professionals from the community (architects, artists, physicians, and writers, among others) contribute their expertise and resources. Technology is readily available and enables students, teachers, and administrators to seek knowledge and expertise beyond the school building.

The George Lucas Educational Foundation (GLEF) Web site, Edutopia Online, celebrates the unsung heroes who are making "Edutopia" a reality. They have shown what can be done, often with the same number of resources as other schools and sometimes with fewer. The Video Gallery is a robust archive of short documentaries and expert interviews.
that allows visitors to visualize what these innovations look like, both in
the classroom and in the words of teachers and students. Detailed
articles, research summaries, and links to hundreds of relevant Web
sites, books, organizations, and publications are also available to help
schools and communities build on successes in education.

6.3.5 Professional Societies

National and state professional societies offer outstanding options for
ongoing staff development related to educational technology issues and
implementation. Among those most involved with educational technology
are ISTE and its state affiliate, FACE (Florida Association for Computer-
Using Educators), and the state’s organization for district-level technology
leaders, FCITL (Florida Council for Instructional Technology Leaders).
FCITL typically meets the day before the FETC conference and provides
the single best source of information related to district-level technology

Other state organizations that are active in the area include:

- Florida Association for Media in Education (FAME):
  http://www.firm.edu/fame/. This is the professional organization of
  Florida’s school library media specialists and individuals in related
  educational fields.

- Florida Association of Educational Data Systems (FAEDS). A
  state association founded in 1964, FAEDS is the oldest Florida
  professional association dedicated to the advancement of
  educational technology. http://www.santafe.cc.fl.us/~faeds/

- The educational technology office of the Florida Department of
  Education uses the FCITL e-mail list as a means to disseminate
  information and also to solicit feedback on issues under
discussion. From time to time, the state will offer a workshop,
  seminar, or meeting pertinent to the area. Generally, these are
  coordinated through a state university such as USF or UCF.
  http://www.doe.firm.edu/edtech/
7.0 STANDARDS, PROCEDURES, AND MAINTENANCE

Included in the Technology Blueprint are a number of Major Recommendations. The purpose of this section is to provide a summary of the research and best practices information available to support the recommendations. The major recommendations related to Standards, Procedures, and Maintenance are:

- SPM-1: Revise the Mandate of the Technology Standards Committee
- SPM-2: Re-engineer Key Purchasing Processes
- SPM-3: Fund and Implement a District-Wide Technology Refresh Program

In support of these recommendations, the following information presents current research and best practices for the topics covered in Chapter VII—Standards, Procedures, and Maintenance. To facilitate navigation of the information in this section, the following is a table of contents for this section:

- Technology Standards
  - Classification of Technology Standards
  - Technology Standards Requirement/Criteria
  - Technology Standards Adoption Process
  - Technology Standards Utilization
- Procurement Guidelines
  - Procurement Types
  - Procurement Options
  - Software Procurement
  - Hardware Procurement
  - Voice, Video, and Data Procurement
  - E-Commerce/E-Procurement
- Maintenance Procedures
  - Software Application License and Maintenance
  - Network Maintenance and Support Contracts
  - Fixed Asset Management Plan/System

The need for standards is summed up in a quotation: “Standards improves [sic] the lives and productivity of people so the man on the street benefits from having an array of devices to choose from.” Information Technology Standards Committee www.itsc.org.sg (July 29, 2005).

Information technology follows a life cycle encompassing the development of technical standards, procurement of technology, and maintenance of that technology throughout its useful life (see figure 1). To create the best educational outcomes and generate the highest level of return on investment, each of these steps must be effectively addressed in a coherent manner. This section addresses each of these elements.
In addition to nationally researched approaches, the current work of the M-DCPS and the state of Florida is reflected in this body of knowledge.

7.1 Technology Standards SPM-1

The research and best practice information in the following section supports recommendation SPM-1 Revise the Mandate of the Technology Standards Committee.

The task of establishing the broad base technology standards process will require the collaboration of technology users and technology providers to:

- identify technology standards requirements
- redefine the M-DCPS Technology Standards Committee
- develop and implement new technology standards procedures
- utilize those procedures to revise existing standards and develop new standards where needed

7.1.1 Classification of Technology Standards

The M-DCPS currently uses a great variety of technology products and services in its operations. In order to simplify the process of establishing
standards, a classification structure appears below with a set of products and services that are recommended as candidates for standards.

In the past, technology standards have not included users’ technology services. Users have not ordered these services, but they have generally been procured through the RFP process based on specifications developed by the Information Technology Services (ITS) organization. The new technology standards committee will evaluate the services listed below to determine whether such services belong under standards control:

- WAN services
- long-distance telephone
- local telephone
- cellular telephone
- Internet

**7.1.2 Technology Standards Requirement/Criteria**

**Infrastructure**

The infrastructure category includes the equipment, which constitutes the data and video networks located in schools and most district facilities. In addition, the security and energy management networks will be included.

These items listed below are not currently covered by standards. The new technology standards committee will develop and implement standards for these items.

- wired LAN equipment
- wireless LAN equipment
- cabling
- servers
- WAN router equipment
- video distribution equipment

**End-user Equipment**

Because end-user organizations usually requisition end-user equipment, all such equipment will fall under standards process control. To date, only workstations and laptops have been under standards control. However, additional end-user equipment will be subject to standards control unless it falls outside the dollar value purchase limits established by the committee. These might include:
Software

For the purposes of simplifying classification, software products for workstations (desktop and laptops) will fall into two categories:

- operating system software which is defined as a software system that manages the basic operations of a computer system
- applications software, for standards process classification, which is defined as any software that is not operating system software

Currently, operating system software falls under the standard of the computer it accompanies; application software is not totally under standards control. The new technology standards committee will develop and implement standards for all applications software programs used by M-DCPS, and bring those programs under standards control.

In addition to workstation application software, there is application software that runs on a server either in a school or from a central location. A best practice for server applications is the requirement of School Interoperability Framework (SIF) compliance to facilitate the exchange of data among the district’s server applications. SIF defines standards for the exchange of data on students, assessment items, assessment results, library, curriculum, food service, transportation, financial, and human resource systems.

Another best practice is to require the use of a common user management system, such as Active Directory for authenticating users. If a user starts work or leaves employment, his/her rights to access systems can be established immediately or terminated promptly, depending upon the situation.

7.1.3 Technology Standards Adoption Process

Best Practice for Technology Standards Adoption

Many companies with large technology usage are relying on technology forecasting to drive their technology planning. Most of these companies supplement their in-house technology expertise by subscribing to services from consulting companies to keep abreast of technology trends. Life-
cycle curves for new technologies are complex and ever changing. One way companies use such information is to help decide on the optimum time to adopt a technology. Currently, ITS subscribes to at least one of these services.

Another best practice is to conduct benchmark projects with other school districts and companies on the use of technology.

Setting a standard is just the beginning. The real issue is in its acceptance and compliance. Keys to standards adoption are the ease of compliance, the difficulty of non-compliance, and value to the end user. Making standards easier to purchase than non-standard items is very important. Having tools, training, and facilities to make the standard easier to use than any non-standard item will only help the momentum of that standard. Widespread adoption is the measure of a standard’s success.

Another best practice is to have the responsibility for emerging technologies as part of the standards committee charter. In this way, the decision on when to commission a pilot to explore any new technology will get district visibility.

7.1.4 Technology Standards Utilization

Technology standards establish a foundation for thoughtful, streamlined procurement strategies to qualify vendors that will deliver the technology equipment, products, and services most needed and correlated with the best total cost of ownership, service levels, and satisfaction.

7.2 Procurement Guidelines

The research and best practice information in the following section supports recommendation SPM-2: Re-engineer Key Purchasing Processes.

"Many businesses make the mistake of bringing in costly and complicated new technology, then leaving the workforce to learn how to use it and adjust to the dramatic change. They also wrongly view the implementation of the new technology as the procurement strategy when it is really simply a tool that enables a strategy to be successful."28 A set of clearly defined policies and procedures for the purchasing of technology is required for M-DCPS to adhere to a process of continuous improvement. The task of developing procurement guidelines requires M-DCPS to conduct the following activities:

- assess and address its current and anticipated procurement requirements and needs

• develop criteria and metrics for the evaluation of procurement options based on purchasing methods, acquisition options, and technology alternatives

7.2.1 Procurement Types

Technology items can be purchased in the following ways. The guidelines should identify the appropriate use for each, their advantages and disadvantages, and the difference in procedures to implement each:

- request for proposal (RFP)
- request for information (RFI)
- district procurement attached lists
- catalog purchases

7.2.2 Procurement Options

M-DCPS may acquire technology items through the following options, depending on several fluctuating factors, such as interest rates, tax laws, accounting standards, etc. Currently, technology items are routinely purchased. Developing a strategic mix of these options may realize significant savings:

- purchasing
- leasing
- operating leases
- sale/lease-back strategy
- rental
- refurbished equipment

7.2.3 Software Procurement

The M-DCPS has become a large purchaser of computer software. For this reason, it is important that the district develop a software license-procurement strategy that uses all appropriate license alternatives as well as leveraging district, county, and state buying power.

The ITS organization is currently deploying this best practice described below.

As more schools and departments become part of the network and more shared or concurrent use license products are distributed, the job of managing software licenses will grow increasingly complex. The use of asset management tools like license management software will not only make the management of software assets easier but will also improve the
productivity of network administrators. M-DCPS is currently in process of installing such capability. Usage-reporting software will allow management to review the trends of a software product to detect declines in usage and to avoid payment of fees by reducing the number of licenses. These reports can also identify abandoned software on which the district could still be paying periodic update and support fees. These abandoned licenses will be used to trade-in on new licenses, where applicable.

Software is now going to be covered by standards under the re-established technology standards committee, thus requiring adherence to standards for purchases of software products. Some of the important categories of software are listed below.

- portals
- integrated learning systems
- productivity tools
- instructional technology
- student/school management services
- administrative support services
- parent/student home licenses

7.2.4 **Hardware Procurement**

Hardware purchasing and the tracking and documentation of technology equipment, is a critical element of any enterprise. Given the decreasing lifetime utility of technology hardware in recent years as the collective body of the computing technology has rapidly evolved, it is even more important that a well-documented system be in place for the provisioning of hardware and its post-purchase tracking via an asset/inventory management system. Once hardware standards are in place, the complexity of the procurement process is greatly reduced and opens up several avenues to achieve economies of scale with special volume pricing programs offered by manufacturers and resellers.

The updating of standards and subsequent refresh of procurement strategies will align M-DCPS along the path of technology enablement as new computing trends and technologies and emerge. Technology must be kept current, within available resources, and replaced, upgraded, or repurposed based upon a life-cycle process.

The range of hardware covered in the procurement guidelines includes the following list of options:

- workstations
- printers
- scanners
• wiring
• hubs
• routers
• transmitters/receivers
• wireless hand-held devices
• other peripherals and devices

7.2.5 Voice, Video, and Data Procurement

A technically robust enterprise network is one that integrates voice, video, and data communications systems. The current network expansion and is a tribute to ITS foresight. Sound procurement processes, strategically aligned to integrate the district’s communications systems will prove cost-effective long-term.

The assortment of voice, video, and data equipment essential to the productivity of the district include the following:

• telephone systems
• televisions, video cameras, and recorders
• photographic equipment and cameras
• voice response/management systems
• automatic dialing systems
• video capturing, broadcast, receiving, and distribution systems
• teleconferencing systems
• radio systems
• office copier, imaging, and document management systems
• paging systems
• intercom systems
• facsimile systems
• projection systems

7.2.6 E-Commerce/E-Procurement

For relatively low-cost, low-dollar volume items, such as supply items and add-on items, many districts develop an online e-procurement capability which will allow users to order such items directly from supplier Web sites, based on a contractual agreement between the district and selected suppliers. The district will train school personnel to employ these e-commerce solutions and align their use with the procurement guidelines.
A best practice is to use Electronic Data Interchange (EDI) in these transactions.

7.3 **Maintenance Procedures**

The establishment of a preventative maintenance program and life-cycle process will enable a strong support organization. This proactive approach will require M-DCPS to devise a process for the systematic tracking of technology equipment performance and maintenance history. Installing an asset management system turns a reactive organization into a proactive organization and provides all these functions.

7.3.1 **Software Application License and Maintenance**

ITS is well underway to installing the capability to provide software upgrades and patches to all networked computers from a remote site to improve version control and license compliance.

7.3.2 **Network Maintenance and Support Contracts**

Refer to Chapter X: *Communications and Network Infrastructure* for a detailed discussion of network maintenance and support strategies.

7.3.3 **Fixed Asset Management Plan/System**

It is recommended that M-DCPS establish a fixed-asset management plan and supporting database application.
8.0 POLICIES, PROCEDURES, AND SECURITY

Included in the Technology Blueprint are a number of Major Recommendations. The purpose of this section is to provide a summary of the research and best practices information available to support the recommendations. The major recommendations related to Policies, Procedures, and Security are:

- PPS-1 Establish Advisory Groups for Formalizing Technology Decisions
- PPS-2: Develop Equity and Access Improvement Plan
- PPS-3: Establish a Cyber Security Audit
- PPS-4: Continue Comprehensive Management Plan for Spyware, Adware & Malware
- PPS-5: Implement a secure and reliable roaming ID capability where users can remotely access their desktops
- PPS-6: Support Legislation Regarding Management and Use of Technology Funds

In support of these recommendations, the following information presents current research and best practices for the topics covered in Chapter VIII—Policies, Procedures, and Security. To facilitate navigation of the information in this section, the following is a table of contents for this section:

- Technology and Information Policies
  - Policy Use
  - Disposition of Assets

Policies and procedures play an important role in maximizing the effective integration of existing technology resources. They are necessary to realize economies of scale, efficiencies of human resource development, and the establishment of an effective customer support system. There needs to be clear criteria for determining what core district policy is and what is site-based. M-DCPS needs to establish and clearly define the collaborative process for developing and implementing technology policies and decision-making parameters to meet emerging needs.

8.1 Technology and Information Policies

The importance of efficient management of technology and information resources grows as systems, networks, and applications become more complex. Management of heterogeneous distributed systems calls for a new methodology to replace explicit control and reactive management with effective, automated, and proactive management. Policies that define characteristics and function of systems and operations have been recognized as a concept to support this complex management task by specifying means that enable the definition and enforcement of necessary principles.
Enterprise-oriented technology aimed at the acquisition and use of technology and information systems include:

- objectives for utilization and benefit of technology and information resources,
- definition of protocols, industry standards and functional requirements,
- operational and managerial requirements.
- procurement and managerial requirements

8.1.1 Policy Use

Policies are set from the top down. They set major direction, rules of engagement, and outline to effect behavioral changes in the organization.

Policies are found at every level of an organization forming a hierarchy. In education this hierarchy starts at the federal level and the state, extending to the Board and into departments and schools. At all levels, policies specify the desired characteristics, capabilities, and functions of the underlying resources.

At each level, the nature of the policy is more finely resolved. Federal policies define overarching values for states, and states render these policies with more specificity to meet the desires of their constituency. At the federal and state levels, policies are generally qualitative and subjective. At the district, department and school levels, policies can be quantitative and objective in form, in particular for technology and information systems.

Policies are often the link between regulatory agencies, district administration, and technology management; thus, the word "policy" is surrounded by a vast number of other related terms, including strategy, goal, vision, direction, mission, process, tactic, procedure, plan, scheme, course and guideline, to name a few.

A formalization of policies and their application seems possible and necessary. The development of management platforms is a way to integrate the concept of policies into management methodologies.

Policies define what management has to accomplish. At the information and technology level, this includes protocols, functionality, organization, and other operational aspects. In order to be meaningful, policies must be turned into actions; hence, they have to be transformed into an algorithmic and functional representation.

Within the district, policies fit within a formal hierarchy as noted below:

- strategic direction
mission and goals
objectives
policy
management procedures and processes
technology and information systems and services

Another hierarchy to classify policies themselves includes:
principal or strategic policy
directional policy
organizational policy
functional policy
process policy
procedural policy

In these hierarchies, it is possible to form a direct connection between strategy and actions and functions at the systems level. From a technical perspective, functional policies are the fundamental means to implement strategies and support administrative and user objectives. Process and procedural policies drive the design and implementation of systems.

The following aspects form a minimum set of characteristics required to define a policy:

Goal: a description of the policy's aims.
Target objects: the objects that are directly affected by the policy, including domains as objects.
Triggers: the initial cause for a policy to take on actions. These may be the same objects or events to be monitored after the policy enforcement instructions are set off.
Policy actions: the functional aspect of a policy, including what (not how!) changes or measures are to be enforced—i.e., the policy enforcement actions and instructions. These must include aspects of time, such as the duration of an activity, the monitoring process, or the intervals for monitoring. The modality of the actions is an integral part of the actions.
Monitor objects: objects that measure the suitability, timeliness and efficiency of the policy actions in comparison to the desired goal.
8.1.2 Disposition of Assets

One of the policies that districts are interested in is the disposition of assets. A possible best practice for desktops, laptops, and PDA’s is discussed here.

Typically disposition is one component in a district-wide refresh program. This is part of the program discussed in Chapter VII. The key steps in a disposition program are:

- Identify what hardware and software users need. These can be categorized into images such as one for teachers, one for secretaries, one for managers, one for special power users, etc. One image is not the answer but neither are fifty. A reasonable number are needed that are different enough to warrant their own category.
- Categorize all users into these groups so that the category of each user is known.
- Conduct an asset inventory so that the configuration and age of each asset is known and identified. This is normally achieved through a unique identifier on each asset and then the data are stored in an asset management system.
- When the decision is made to upgrade a user, either reallocate his/her asset to another user or send it to a disposal process.
- Refurbish the asset and then give it to low-income parents to assist in the district’s Digital Divide program. A Digital Divide program must involve policies for loss, Internet access, software license, school network access, etc. Another disposal option could be selling it to refurbishers or another option could be outright donation in an as-is condition.29,30
- Ensure that all data on the asset are erased.

8.1.3 Use of School Technology Resources (off site and after hours)

A growing movement is to consider schools as centers of the communities in which they are located. This builds the stature of the schools and provides needed services to the local community. It also forms needed partnerships between governmental and social service agencies. Instead of competing to offer redundant services, they share and offer combined services.

Some of the emerging uses are:

- Schools as community meeting locations, possibly for a fee. Schools have the facilities that are mainly unused after hours. Many community organizations look for meeting locations, such as homeowners associations, social clubs etc.
- Schools as recreational facilities for the public. These could include all the athletic facilities, pools, gymnasium, and libraries.
- Co-location of libraries with the school building and then combination of the school library with the public library.
- Co-location of a day care center at the school for faculty and families of students.
- Co-location of medical and other health clinics with the school building. As more urgent care facilities expand into the community and as the shortage of school nurses continues, this approach could be of benefit. 31-32
- For off-site access, districts are including parental and student access on a 24/7 basis. Students have access to lesson plans, quizzes, homework assignments, and teacher communications. Parents have access to the student’s performance at school. In additions some schools train the parents as part of their Digital Divide program33.

8.2 Equity and Access

The research and best practice information in the following section supports recommendation PPS-2: Develop Equity and Access Improvement Plan.

This section addresses specific issues related to development and implementation of policies and procedures to achieve equity. Chapter III of the Information Technology Blueprint includes a comprehensive perspective on equity. Chapter XI addresses the equitable implementation of technology and information resources.

8.2.1 Non-Technology Related Equity Issues

Equity policies and procedures must address conflicting issues that arise due to circumstances beyond the implementation of technology. For example:

32 "Julia Richman Education Complex" www.jrec.org Reviewed on July, 2005
33 Henrico County Virginia’s school district www.henrico.k12.va.us/ibook Reviewed July 2005
• Temporary Classrooms: The district currently has a mixture of two different types of temporary classrooms. The more functional is the modular classroom that comes wired for network access, thus requiring only a network connection or signal from the school building. The less functional is the relocatable classroom, which is not pre-wired for network connectivity. While the relocatable classrooms must be networked, they also must not be considered permanent. In addition, when some relocatables have been moved, existing network connections have not been re-established. Most relocatable classrooms have no restrooms. Many relocatables do not have covered walkways. Difficulties arise in moving or carrying materials and equipment, such as monitors, up ramps. Space is usually smaller for a relocatable classroom for technology equipment and workstations.

• Technology support: Specialists may not be readily available, thereby causing inequity in support.

• Standards: At times, standards are not flexible enough to accommodate variations to achieve equity. For example, iMacs take up less room, making them suitable for portables; but, for other reasons not related to equity, desktops are the only standard that can be purchased.

• Funding: Distribution to schools is equitable; but if one school spends money on teachers and another, on computers, over time, the school hiring more teachers but less technology is rewarded with new technology. The other school that chose computers ends up with reduced funding.

The development of critical-mass guidelines and configurations for classrooms and learning environments provides one of the means to reach equity objectives. A school-level policy for assessing interrelated elements of technology integration will help to ensure a systemic approach to monitoring critical mass. Using such a rubric, schools will be able to assess their status regarding technology availability and access, and communicate results to the district.

8.2.2 Equity Policies and Issues

The district also seeks to align district- and school-level technology policy. Consensus on policy may be reached, adopted, and communicated effectively system-wide.

Policy development to address equity will:

• identify equity as a specific hierarchy for classification
• develop a list of necessary policies based on peer research
• build a catalog of current policies
• assess gaps and draft new policies for review
• establish review committees and policy adoption process
• establish policy use and compliance processes

In addition to the elements defined, each policy includes the objectives of applying the policy to remediate inequitable conditions. Some solutions are readily understood and already under way. Others may provide alternative strategies.

Issues of equity include:
• definitions of critical mass
• definition of equity policies as subset of district policies
• technology-based assistive and adaptive resources

Addressed in greater depth in Chapter III, adaptive and assistive technologies and the universal access/universal design model provide the means to help achieve equitable access to teaching and learning resources for all students, especially those with physical and learning challenges.

8.3 Security

For any size enterprise, network and information security has become an issue. The advantage of having a worldwide network that can access many applications from anywhere poses many problems. Security issues have increased greatly with mobile computing and personal devices (cell phones, PDAs, etc) that are capable of being tied into a network. Some of the best practices currently in use are discussed below.

8.3.1 Authentication, Authorization, and Access

Authentication is the process of ensuring that each user is who he/she claims to be. All applications rely on user identification (authentication), and there are several major technologies in use today34.

• User IDs, Passwords, and Pin numbers require personal knowledge and are the most prevalent today.
• Tokens or smart cards require devices that only the user carries.
• Fingerprint, voice recognition or retina scans require physical features unique to one person.
• Using more than one form of authentication increases security. The most popular authentication method today is a UserID with a

password (with personal questions if the password is forgotten). Each step is more costly to implement than the previous one.

Authorization is the process of determining the rights of an authenticated user to access specific networks, data, or applications. These access rights are general, based on the user’s role and might include whether the user can only view data or has the ability to change data. Typically, the current practice is to keep this data in a profile of all users to show who that user is and what authorization he/she has access to and what rights he/she has to that application (update or read only).

Best practices for authentication, authorization, and access include:

- Every user, including students, has a unique ID and password
- Authentication is managed centrally for the entire district and for all applications and services,
- Authentication is automatically updated daily by changes in the human resource and student system.
- All applications use the central authentication service, including file/print servers, HR, finance, student system, email, assessment, library system, payroll, work order system, portal, etc.
- All users are automatically assigned roles, such as student, teacher, administrator, etc. as determined in the HR/SIS system. The roles provide a set of rules that authorize what a user can do and what they will see.
- All workstations (PC and Macintosh) use the central authentication. As a result, a teacher and a student can log on to the same computer and have very different capabilities.
- Regardless of where an individual accesses the network, the individual’s access to applications and data is the same.
- There is minimal manual maintenance of each individual profile. Changes to passwords are performed at self-service kiosks.

8.3.2 Network and Application Security and Single Sign-on

Single Sign-on (SSO) allows all users to access all authorized resources seamlessly on the network on the basis of a single authentication that is performed when they initially access the network. Historically, after logging on to the network, you might then be asked for another username and password if you wanted to access email; and another for accessing the student information system. SSO allows access to all authorized applications with a single logon. SSO can improve the productivity of users, reduce the cost of network operations, and improve network security35.

This is the best practice used in contemporary organizations. It removes much of the manual complexity described above but has a cost associated with it. There are software products that enable this application but there is a sizeable implementation services effort associated with it. It requires a central enterprise directory and then links to each application, so installing this application needs care. To the user it is a real benefit.

M-DCPS is in the process of installing the first steps of this single sign on through the project known as “Password Reset” that provides the same password for all district assigned user IDs. The visible part of the project is a self service kiosk for resetting passwords. Behind the scenes the system synchronizes the passwords among the mainframe and servers throughout the district no matter where the password is changed.

### 8.3.3 Physical Security

Physical Security involves permitting or denying access to all users into a building or room within a building. Technology can assist in many forms with physical security. The current practice is to have a list of authorized users who have permission to have access to a building that is available at a manned guard station when someone manually signs in. For those who are not on the authorized list, some alternatives include:

- a visitor pass, which may be a sticky paper tag or plastic badge. The pass may contain a picture of the visitor and the floor or area that he/she is authorized to visit.
- a driver’s license exchange for visitor pass. The badge may contain the visitor’s picture.
- badge access via a reader, which looks at the magnetic stripe or bar code and compares the name to a pre-approved authorized list for electronic access. Some readers may require a pass code in addition. Entry might also require passing through a metal detectors or other scanners.

Fingerprints, voice prints, or retina scans are all being used by early adopters as a more positive means of physical security checking.

The most common form for physical security checking, today is a combination of the manned guard station for visitors and badge access for employees of the organization. Most schools today are enclosed with fences, have a central entry for access, and roving security staff. There is a move, especially within transportation, to positively identify via biometrics each student entering or leaving a bus.
8.3.4 Surveillance/Monitoring, Including Security Cameras

Most schools have started to implement surveillance/monitoring systems. Homeland Security is funding some of these installations. While most have started, most do not have complete installations yet. Some features of a best practices system include:\(^{36}\):

- **digital recorders and digital phones.** These allow tracing of incidents and also eliminate the manual tape changing and storage in analog systems.
- **standard alarms, video equipment and access controls** so that procedures operate seamlessly and are interoperable.
- **a central monitoring station** with a central response capability
- **a link to all the wireless networks** into this system
- **police access** to this network, to ensure as they drive up in a cruiser that their laptops can access individual cameras within the school.

8.3.5 Deploying Wireless Technology for Criminal History Checks and Writing Reports

Background checks for district hiring have become even more important lately. The issue is obtaining this information in a timely and cost-effective manner. Current processes in some districts take up to three months to obtain the background and certification data for new hires. The Homeland Security organization has set up a program called National Criminal History Improvement Program. This significantly increases the data accuracy and on-line capabilities of criminal records, sex offenders, county and court data, and law enforcement data, all with electronic fingerprints. The move is to make other databases accessible with this, such as drivers’ licenses and credit card data. The need is for faster and cheaper access to all these data so that vendors will get into this business by offering technology to support wirelessly, almost instant checks of these databases. There will be a fee for these services, but at this time they are less than the fees charged for the current background check processes. It is a more complete background check, with more capability being added all the time.\(^{37}\)

8.3.6 SPAR Solution

The State of Florida Juvenile Justice Reform Act of 1995 requires each school district to link juvenile violence incidents to the action taken by the


student’s school and the district. School districts are required to collect data about violence incidents involving students during each school year and transmit a report to the state. Discipline reporting is required for suspensions (indoor and outdoor), court of juvenile referrals, alternative placements, and expulsions.
To comply with these requirements, Miami-Dade County Public Schools developed the SPAR system (School Police Automated Reporting) system. M-DCPS has its own school police organization that works in cooperation with other local city police organizations. SPAR was originally written to record incidents of violence involving students.

When an incident occurs on a school campus, on school-sponsored transportation, or even off-campus, the school notifies the Dade County Public Schools (DCPS) Police Department. The school police enter the incident information into the system and a unique tracking number is assigned. By assigning an identifying number to each incident of violence, the system links the district's database for student discipline with that of the local schools’ computers. Each school has access to the incident number as well as to the information entered, and makes disciplinary decisions. The schools are responsible for updating the system with any relevant information on the incident.

The incident reporting system links with the ISIS Student Case Management and Attendance suspension information.

The SPAR system enables teachers and authorized persons to obtain batch or profile reports that can identify student demographics and incident details, such as number of students involved, type of violation, location of incident, and type of disciplinary action taken. A real benefit is the SPAR system’s ability to produce many different types of reports, which aid security personnel and administrators in developing individual school security plans. A summary report is submitted annually to the Florida Department of Education.

Recently this system was upgraded with a $1 million dollar grant from the Department of Justice. Additional capabilities were added to SPAR for dispatching, mobile reporting, and records management. The district is presently in the process of upgrading from the SPAR system to the OSSI’s COTS Incident Reporting System. The enhanced system also provides the reports for Florida Department of Law Enforcement (FDLE).

This system is being used in several other districts in Florida. It is providing a comprehensive set of functions for this internal police organization using server technology. With the added capabilities installed, it is an effective system for the district.38

Best practices in this area would include the ability for the community police to tie into the school network to view on the video network what the status is inside the school from the police cruiser’s laptop. In addition the police officer would be able to access the database described above.

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38 The School Police Automated Reporting e-handbook, as viewed August 10, 2005 <System http://sus.dadeschools.net/helpdesk/answer.asp?id=74&index=74.htm>
8.4 Information and Technology Policies in Support of Instruction

All classrooms need a minimal set of technology to effectively deliver instruction and to facilitate student learning. To support instruction, policies are defined that establish a minimum set of technology for every new classroom, existing classroom, renovation, and relocatable. The classroom technology typically varies by grade level and subject. The policy also defines who is responsible within the district to oversee the implementation of the policy.

By having a standard curriculum and instructional technology standards, developers can be confident that the technology to effectively deliver instructional content is in place throughout the district for the grade level and subject. Curriculum and instructional developers are reluctant to incorporate technology into their instructional content when a significant number of classrooms are not able to take advantage of the technology-enhanced lessons.
9.0 ADMINISTRATIVE COMPUTING AND DECISION SUPPORT SYSTEMS

Included in the Technology Blueprint are a number of Major Recommendations. The purpose of this section is to provide a summary of the research and best practices information available to support the recommendations. The major recommendations related to Administrative Computing and Decision Support Systems are:

- ADS-1: Establish quarterly meetings for the ITS Advisory Committee
- ADS-2: Name an ITS customer liaison for each major organizational unit
- ADS-3: Procure an enterprise resource planning (ERP) system for business functions
- ADS-4: Procure an “ERP for Learning”
- ADS-5: Implement the RFP for a Comprehensive Document Management System
- ADS-6: Obtain licenses for Easy-to-use Query, Analysis, Reporting, and Dashboard tools

In support of these recommendations, the following information presents current research and best practices for the topics covered in Chapter IX. Administrative Computing and Decision Support Systems. To facilitate navigation of the information in this section, the following is a table of contents for this section:

- Information Systems Strategies
  - Definition of Systems
  - Departmental Integration/Interaction
  - Aligning Business Process and Information Systems
  - Data Consolidation and Sharing
  - Digital Learning Dashboard
  - Information Ownership and Accountabilities
  - Beneficial Use of Information Systems

- Business Systems Integration
  - Enterprise Resource Planning (ERP)
  - School Interoperability Framework (SIF)
  - Functional Modules
  - Personnel Time and Attendance System
  - Audit Services Tracking System
  - Centralized Banking
• Instructional Systems
  – Student Information System
  – Gradebook
  – Learner Support Services
  – Media Management System
  – School Book Inventory System
• Support Services Systems
  – Food Services
  – Transportation
  – Utilities, Security, and School Safety
  – Facilities and Construction Maintenance
  – Inventory Management
• Decision Support Systems
  – Decision Support Framework
  – Data Warehouse
  – Web-accessible Query, Analysis, and Reporting Tools
  – Data Warehouse as Transition Strategy

This section addresses best practices utilizing current research in the following major topic areas:
• Information Systems Strategies
• Business Systems Integration
• Instructional Systems
• Support Services Systems
• Decision Support Systems

In addition to nationally researched approaches, the current work of the M-DCPS and the state of Florida are reflected in this body of knowledge.

9.1 Information Systems Strategies

The IT Governance Institute has developed a comprehensive set of guidelines and frameworks for the effective integration of Information Technology into an enterprise’s operations. They have identified the following list of Critical Success Factors:
• IT governance activities are integrated into the enterprise governance process and leadership behaviors
• IT governance focuses on the enterprise goals, strategic initiatives, the use of technology to enhance the business and on the availability of sufficient resources and capabilities to keep up with the business demands

• IT governance activities are defined with a clear purpose, documented and implemented, based on enterprise needs and with unambiguous accountabilities

• Management practices are implemented to increase efficient and optimal use of resources and increase the effectiveness of IT processes

• Organizational practices are established to enable: sound oversight; a control environment/culture; risk assessment as standard practice; degree of adherence to established standards; monitoring and follow up of control deficiencies and risks

• Control practices are defined to avoid breakdowns in internal control and oversight

• There is integration and smooth interoperability of the more complex IT processes such as problem, change and configuration management

• An audit committee is established to appoint and oversee an independent auditor, focusing on IT when driving audit plans, and review the results of audits and third-party reviews.

To measure the performance of the IT organization, The IT Governance Institute uses the following Key Performance Indicators:

• Improved cost-efficiency of IT processes (costs vs. deliverables)
• Increased number of IT action plans for process improvement initiatives
• Increased utilization of IT infrastructure
• Increased satisfaction of stakeholders (survey and number of complaints)
• Improved staff productivity (number of deliverables) and morale (survey)
• Increased availability of knowledge and information for managing the enterprise
• Increased linkage between IT and enterprise governance
• Improved performance as measured by IT balanced scorecards

There are multiple strategies to take into account when modifying, upgrading, or replacing information systems in an organization as large as that of M-DCPS. Factors such as impact, integration, and urgency need to be considered along with Total Cost of Ownership (TCO), technical requirements, and support. The tasks can sometimes seem overwhelming due to the numerous applications that are currently deployed and the need to move towards an integrated systems architecture and away from a heterogeneous or silo system architecture.
There are two approaches to implementing of any of the four major system categories described below. One is installing the best application in class for each of the applications. This involves buying the best applications that exist and interfacing them with other such best-in-class systems. The district becomes responsible for integrating the applications and for maintaining integration over time. This approach ensures that each department gets the best that exists in each application area.

The second approach installs an integrated system that covers all the individual applications. However, each application may not be the best in its particular field. The vendor becomes responsible for initial and ongoing data integration. This means all the data is defined once with the same format and meaning, is entered and edited once at its source, and is immediately available to all areas within the integrated system. This approach achieves real-time data reporting across applications.

9.1.1 Definition of Systems

There are four major categories of systems deployed within the district. These systems are related to the core business processes, instructional processes, general district support processes, and decision support of the district.

Business Systems

Business systems are the applications and processes related to the financial operations of the Miami-Dade County Public Schools. The systems and processes include human resources, payroll, accounting, purchasing, document management, etc.

Support Systems

Support Systems are the applications and processes that are related to functional requirements within the Miami-Dade County Public Schools. The systems and processes include food service, transportation, facilities, etc.

Instructional Support Systems

Instructional Support Systems are the applications that keep track of student performance, schedules, media systems, special education, etc.

Decision Support System

The No Child Left Behind (NCLB) legislation, coupled with the private industry success in using data to forecast and make informed decisions, are making the importance of implementing an effective decision support
system both valuable and critical at the school, district, state, and federal levels. Districts require tools to gather, analyze, forecast, proactively change, and assess ways the instructional needs of the students can best be met.

9.1.2 Departmental Integration/Interaction

Because the organizational structure of M-DCPS is vertical while application data spans horizontally, a thorough understanding of the interaction and integration of all M-DCPS departments is critical to the success of systems deployment throughout the district.

9.1.3 Aligning Business Process and Information Systems

Too often information systems are designed to align with current business processes, regardless of whether or not those existing processes are essential or critical to the district needs. A strategy needs to be implemented when modifying, upgrading or deploying new information systems to audit and alter (when necessary) relevant district processes.

The definition and use of processes is a powerful tool in modern organizations. While processes have always existed, it is only in the last four decades that they have been formalized and clarified so that they can be managed and measured, allowing management decisions to be made based on factual circumstances. The process audit provides the means to define clearly the processes and their role in the organization. Audits provide an objective evaluation of how an organization's processes compare with standards and best practice examples in similar organizations. They also identify approaches that can be used to help an organization become more process-centric.

While process audits can span the entire enterprise, most focus on a department or group. In each case, the audit team:

- meets with enterprise management to define the scope of the audit
- gathers information through questionnaires, phone calls, and on-site interviews to ascertain both internal perspectives of those engaged in processes and those who are the recipients of the services delivered by those processes
- organizes and charts processes indicating information flow, decision points, work processing points, resource allocation and use, underlying information and communication infrastructures
• drafts a report that presents the findings and recommendations to administrators and decision makers

• creates an audit report which describes the processes in use today, suggests changes that might be undertaken to make improvements, and discusses the benefits and consequences those changes might achieve

9.1.4 Data Consolidation and Sharing

The No Child Left Behind (NCLB) Act and the requirements related to the reporting of Adequate Yearly Progress (AYP) have shifted the need for data consolidation and sharing from a district desire to a federal and state mandate. One former educator stated, “...In addition to being required to report data on various demographics, educators are now challenged to compile data from a variety of sources to aid in management and instructional decision making.”

Any organization that desires to use a suite of standard applications for information management must account for heterogeneity. Discussions of heterogeneity revolve around the diversity of legacy, custom-built applications that run most organizations, and the interoperability problems that result. While striving for a single suite is admirable, market research indicates that information systems presently are—and will remain for the foreseeable future—heterogeneous environments built up from a combination of applications. Single vendor, end-to-end solutions exist only in the marketing literature of software companies trying to sell them.

The single-suite attitude is based on the idea that integrating multiple-point products to solve a technology problem is inherently more expensive and riskier than buying a single solution. This attitude still has power despite the emergence of Internet standards and middleware that provides the means to loosely couple the interoperability of data systems. Unfortunately, most organizations have as much difficulty standardizing enterprise-wide on vendors and tools as they do on network and communication standards. Although a department or school might implement technology in a standard way, educational and administrative processes typically span several of these sub-organizations—which means that district requirements will demand solutions that span technological and standards boundaries across these groups.

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9.1.5 Digital Learning Dashboard

Imagine being a student, parent, teacher, or administrator who needs access to information even though parts of the information are spread across multiple systems, locations, and databases. Creating and storing information is useless unless there are mechanisms for users to obtain it in ways which are easy to use, understandable, comprehensive, and current. Using Web-based interfaces, educational portals delivering digital learning dashboards can provide the vehicle for the necessary access. Educational portals can be developed that provide customized access and views that depend upon the specific role of the user. The portal also establishes a common framework for accessing and looking at information. Like the instruments on a car, the user can glance at the critical information. Key indicators are defined by the user population and, with a mouse click the users can drill down into multi-dimensional sources of information. Much of the complexity of working with the information is eliminated by providing quick and easy access to the most important data, documents, and materials. The mechanics of gathering data are transparent to the user who is able to concentrate on using and applying the information.

Figure 9-1: Integration of Information within M-DCPS
9.1.6 Information Ownership and Accountabilities

Information Ownership and Accountability, also referred to as Data Management, is a significant variable that contributes to efficiencies and reporting accuracies if addressed early in data consolidation and sharing initiatives. Data Management can be defined as:

- the systems and personnel responsible for data elements, integrity, and reporting
- the methods for propagating data to other systems

The Miami-Dade County Public Schools need to clearly define a methodology for Data Management. To ensure a successful data management implementation the district needs to overcome the following challenges related to perceived responsibility:

- No department feels it is responsible for the problem.
- Data Management requires cross-functional cooperation.
- Data Management requires that the district recognize that it has significant problems with data sharing and consolidation.

One of the more significant challenges is that no single organizational unit is responsible for all of the data in an enterprise, and the inclusion of a responsibility for data quality in a job description is very unusual. Furthermore, once data is in the computer, organizational units often wash their hands of the problem and blame it on ITS. ITS cannot create the business rules, nor should it be held responsible to make business decisions concerning the data. ITS can only ensure that electronic rules, based on business rules, operate correctly and that the data is safe and secure.

Data management provides organizations with the ability to share data and to ensure that the data definitions are consistent. Effective data management requires organizations to adopt a data stewardship approach. Stewardship is different than ownership. A steward is a person who is expected to exercise responsible care over an asset that he or she does not own. The data is actually owned by the enterprise. The steward is responsible for caring for that asset. Data stewardship is important, but establishing a data stewardship program is very difficult. One of the immediate challenges to a stewardship program is to identify the group or person responsible for a set of data.

9.1.7 Beneficial Use of Information Systems

Information systems and the data and reports that are generated through such systems are beneficial if they help the district meet federal and state requirements, and improve student achievement and the efficiency of the organization.

Meet Federal and State Reporting Requirements

“The No Child Left Behind Act’s assessment and reporting provisions cast a spotlight on the value of information for school improvement. At the same time, the law’s accountability provisions push schools and districts to accelerate the pace of improvement.”

M-DCPS is now mandated to report increasing amounts of various data elements to the state as well as federal agencies. The information systems currently deployed, as well as those systems to be deployed in the future, need to account for this requirement and be designed to help streamline the flow of information so that meeting these demands is a simple task, not a burden.

Improve Student Achievement

Through integrated systems that communicate data horizontally, the district can spend less time retrieving data and analyzing results and more time implementing change to affect future results. Principals and administrators will be empowered to hypothesize about why a group or class is performing poorly, or better yet, why a group or class is excelling. Changes can be applied sooner and the results can have a dramatic effect on student achievement.

Improved Efficiency

Systematic modifications, upgrades, or overhauls should only be conducted if the change has a lower Total Cost of Ownership (TCO). This can mean that a new proposed system costs less to purchase and maintain or that it reduces time on task, or both. By investigating department integration, conducting a business audit, and deriving methodologies for optimum data sharing and data management the district will reduce the TCO not only by reducing cost but also through increased operating efficiencies.

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9.2 Business Systems Integration

Business systems are defined as those applications necessary for the operation of the school district. Primarily, these are applications such as the general ledger, payroll, purchasing, etc. Over the course of many years, the district has amassed multiple systems to meet business needs. During the next several years, the district will be upgrading, replacing, and customizing these applications to enable more efficient operations and data sharing. (Systems integration should not be confused with data warehousing and decision support. Data warehousing is a tool to facilitate decisions through the analysis of data. The goal of systems integration is to streamline operational efficiencies.) There are two approaches that the district needs to consider for integrating all of the business systems together. The first is an Enterprise Resource Planning approach and the second is the adoption of an approach similar to the School Interoperability Framework.

9.2.1 Enterprise Resource Planning (ERP)43

The research and best practice information in the following section supports recommendation ADS-3: Procure an enterprise resource planning (ERP) system for business functions.

ERP is the current generation of resource planning systems, that replaces “islands of information” with a single, packaged software solution that integrates all traditional enterprise management functions. In simplest terms, ERP systems use database technology and a single interface to control the all-encompassing information related to a company's business. Along with functionality for enterprise and supply chain management, ERP is typically associated with the use of client/server (recently with Internet Computing Architecture (ICA) as well), relational database technology, and UNIX, Windows NT, AS/400 or mainframe operating systems. At M-DCPS, the vendor is responsible to provide technical upgrades, functional enhancements, and maintenance of all integration points between system modules for an annual maintenance fee. This would have a significant impact on reducing the total cost of ownership (TCO) for an organization’s computer systems if it were not available.

9.2.2 School Interoperability Framework (SIF)

The School Interoperability Framework is a system architecture and standard adopted by educational software manufacturers to enable the integration of heterogeneous system applications. It is a push/pull technology that enables different applications within the district to communicate with each other. It is foreseeable that the district will both build an ERP system for business critical applications such as payroll, general ledger, and purchasing and also utilize some functionality of a SIF approach for supporting data exchange among such systems as student, transportation, food services, library, assessment test items, assessment results, authentication services, and curriculum management.

9.2.3 Functional Modules

Regardless of the approach, there are functional modules that are critical to the success of a business systems integration project. These include, but are not limited to: Finance, HR, Purchasing, Warehousing, and E-commerce. By integrating these five modules, the district can reduce inefficiencies and improve operations, and perhaps utilize the savings for other critical initiatives.

Finance

The financial services module is one of the most critical components to any business operation. The current application utilized for finance (more specifically the General Ledger) lacks the real-time reporting capabilities that would improve efficiencies throughout the district.

An upgraded financial application that can be queried through a Web interface could enable principals and department heads to track their budget without having to spend countless hours keying redundant information.

Human Resources and Payroll

Some enhancements that are currently underway include the rollout of a Web interface for job posting and a modification to report generation. These efforts will improve district efficiencies, reduce the demand on the application hardware, and improve performance. With the number of new staff being recruited every year, contemporary systems could provide significant advantages.
Some of the best practices in human resources involve process improvements such as using videoconferencing for the initial interviews of candidates who are not local. Another could be subscribing to a service that provides certification validations in less than a day.

In a similar manner, some of the payroll best practices are: (1) pay a person at the correct rate in the next pay cycle and not four-to-eight weeks later with an adjustment, and, (2) put all employees on direct deposit. A free checking account, with no background check, and a debit card would be issued to all employees.

**Purchasing**

Purchasing is a key component or module when implementing an integrated business system. Most financial systems include a module related to purchasing that enables data sharing between procurement and accounting. The key element of a new purchasing system is not necessarily the integration with accounting that is a given but rather the integration with other supporting systems. These systems could include, but not be limited to:

- **Standards** – The Standards Committee (Chapter VII) is recommending an on-line catalog of district purchasing standards to list part numbers, prices, vendors, etc. to help streamline the selection process for capital and operating expenses.

- **Contracts** – The purchasing module should also interface with a vendor and associated contract database that has current pricing and replacement parts that is maintained by the vendor.

- **Asset Management** – An asset management system would interface directly with the purchasing system to streamline payables and accounting. Principals and Department Chairs would need access to the system for capital expenditure planning and budgeting.

- **Bid Processing** – An automated bid processing and vendor notification e-mail system which would notify all vendors of a specific bid.

**Warehousing and Distribution**

The district needs to migrate from the heterogeneous applications utilized for warehousing and distribution to the integration of the data with the Finance and Purchasing systems. This step should follow the upgrade, modification, or replacement of the financial and purchasing system.
E-commerce and E-Procurement

Through the integration of the aforementioned modules (Accounting, Purchasing, Payroll and Warehousing), the vision of a Web portal for e-commerce or e-procurement can become a reality. The system could be as simple as a user interface to the integrated business applications.

9.2.4 Personnel Time and Attendance System

Rather than recording time attendance on a manual sheet to be input into a system later, contemporary systems use employee ID readers or biometric readers, such as fingerprints or retina scans, for time and attendance. Time in and time out are captured and the hours worked are calculated automatically.

9.2.5 Audit Services Tracking System

M-DCPS audit practices are paper intensive. There are contemporary audit applications that can reduce the amount of paper and significantly improve the auditing process.

9.2.6 Centralized Banking

A direct-deposit program using the employee’s bank or providing a bank to those employees who do not have a bank will improve the district’s productivity and reduce costs. There are banks that would enthusiastically welcome M-DCPS as a client. In some other districts, banks have offered free checking, free debit cards, no ATM fees, and no credit checks.

9.3 Instructional Systems

The research and best practice information in the following section supports recommendation ADS-4: Procure an “ERP for Learning.”

Instructional systems are those applications directly related to the true task of the Miami-Dade County Public Schools, the task of teaching. There is a broad array of systems from Student Information Systems (SIS) that handle scheduling, grades and disciplinary records to Media Management Systems that allow students to check out books, tapes, or videos.
9.3.1 Student Information System

The ISIS Student Information System (SIS) was purchased approximately twenty years ago and has been modified extensively for Miami-Dade County Public Schools. Third-party products such as Pinnacle gradebook and district created programs such as the data warehouse and SPI have been added to make it more effective. Because it is used to satisfy state and federal data reporting requirements, including class size and student FTE, ISIS is one of the most critical applications in the district and serves as the official repository of record for student data.

9.3.2 Gradebook

M-DCPS is installing the Pinnacle gradebook. It provides significantly improved functions to teachers and parents. This critical and effective method for managing and reporting grades and attendance must be incorporated into any integrated ERP for learning system.

9.3.3 Learner Support Services

Contemporary school districts have articulated a vision for a comprehensive curriculum development and instructional management system with dedicated personnel and resources district-wide. A number of components of such a system provide critical data for teaching and learning. M-DCPS has such a vision and has already been assembling parts.

The focus of the next few years will be to expand that vision so that the system will link curriculum with student information, instructional resources, and assessment strategies, and facilitate the orderly flow of large quantities of integrated information that has an impact on teaching, learning, educational management, and decision-making at all levels. M-DCPS educators will use these applications to articulate and catalog learning goals (e.g., content and performance standards and benchmarks, etc.) and crosscutting competencies as they relate to selected curricula. Once standards, benchmarks, and competencies have been electronically catalogued, this approach will allow for the detailing of learning resources as they support teaching processes and strategies that will lead to student achievement of each benchmark.

Teachers will document, record, and electronically share units and lessons that have been successful in achieving desired student performances. The correlation of performance to instructional resources will shift the emphasis away from a curriculum dictated by the textbook to one encouraging inquiry and the development of lifelong learning skills.
(constructivism). The textbook now becomes only one of many resources available to assist M-DCPS teachers in reaching the student educational goals reflected in this approach.

Using these applications, educators and parents will be provided with comprehensive profiles of student performance against designated performances for the duration of a student’s enrollment in the district. A rich variety of information made available to teachers, administrators, and parents will enable them to determine which learning methods, resources, and student assessment measures are contributing most to student attainment of state content standards and M-DCPS standards and benchmarks.

### 9.4 Media Management System

The research and best practice information in the following section supports recommendation ADS-5: Implement the RFP for a Comprehensive Document Management System.

District and school leaders share a vision of school media centers being the hub of information access in the school. If media centers are to survive and grow into information resource centers, the district needs to reaffirm their critical importance. District-wide, media centers should also become a priority in the networking process and be upgraded with enough appropriate technology to enable them to provide direct Internet access and access to central media resources including voice, video, and electronic and hard copy data information. Additionally, while many of the existing media centers have structural, electrical, and spatial constraints, schools designated for renovations should place a high priority on creating such centers.

Some M-DCPS libraries not only provide local resources, but also enable students and staff to access learning materials from across the country and the world. As more media centers become automated and have high-speed access to the Internet, they will include these components:

- locally warehoused books, papers, photographs, software, videos, and CD-ROMs
- electronic virtual library access systems by which a user may transparently connect to remote libraries, databases, and other remote holdings by using the school information and technology resource center’s on-line system. In order to be transformed into information technology resource centers that support voice, video, and electronic and hard copy data information resources, libraries require an automated and comprehensive library media management system that operates over the district’s information technology system.
A comprehensive media management system would enable students, teachers, and administrators to access information resources over the network, search databases, reserve video resources, and request information sources. Key to the success of the 21st century school information and technology resource center is its access from any workstation in the building via the network. Information processing tools should be employed to transform information into more readily usable formats.

The following strategies are considered best practices for automating information and technology resources centers system-wide:

- Research the feasibility of the media system being a central, administrative function similar to other administrative functions (e.g., e-mail, financial, and student information) and compatible with the student information system.
- Move the library automation systems to a uniform client/server software application in a WAN environment over time.
- Define the platform and purchase library management software centrally; implement and maintain it centrally.
- Provide students and staff equitable access to information available over the network including the district learning resources, approved Web sites, Miami-Dade’s Public Library system, and accessible university library systems.
- Develop and implement a plan and timetable for the automation of all school libraries including a comprehensive document and media management system.

M-DCPS’ Division of Instructional Technology, Instructional Materials, and Library Media Services has implemented Follett Software Company’s Web-based Destiny library automation system. The Destiny system includes an on-line catalog of books and is accessible by individual schools, grade-level groupings, or district. This district-wide media system minimizes unnecessary duplication of holdings across schools, allowing individual libraries to develop specialized, in-depth collections. By electronically linking the district’s school information and technology resource centers, these specialized, in-depth collections are accessible to any student, teacher, or administrator.

In addition to addressing automation challenges, the district intends to focus on promoting effective library models, providing professional development, and sharing practices and resources. This will:

- help communicate to school leadership the important role of libraries as information resource centers both now and in the future
- provide local district and school leaders with model configurations for technology-enriched learning environments for libraries
• ensure district-wide professional development plans and programs for school librarians and paraprofessionals to prepare them to manage technology-rich information resources. It will help students and staff use technology as a research tool
• assess success and replicability of existing library-based models, practices, and resources, and expand the use of successful programs.
• design resources to be Web-enabled and accessible by all computers at all school sites and, when appropriate, from home and community centers

M-DCPS will negotiate site licenses with publishers of electronic versions of their books and other print matter. This will enable teachers and curriculum developers to access these electronic books and periodicals and assemble customized, standards-based, teaching materials for use in the classroom. The district network has access to a variety of online databases for use by educators for professional development or classroom activities. Full text is available from many sources and can be stored on the local district server for easy access by school building personnel. Teachers and students can have access to current news for research projects. With access to commercial news services, students will be able to search and browse newspapers, periodicals, and live news reports from sources such as the Associated Press.

Students must also be able to:
• access electronic card catalogs and bibliographic databases within and among schools
• perform inter-library loans, both among schools and with public library and participating university library facilities
• access library databases within the school, at other schools, and at district offices
• access digital library resources (Encyclopedia Britannica, Grolier’s, etc.)

Best practices for cataloging to increase efficiency and accuracy include purchasing books that are ready to be placed on shelves along with accompanying cataloging information in electronic form. Where this is not possible, and for non-print items, a fully networked catalog processing service can be implemented. For a more detailed discussion, see Information Technology Blueprint Chapter III: Teaching and Learning Technologies and Chapter IV: Learning Environments and School Facilities.

School Book Inventory System

The current textbook system (Text) is twenty-five years old and should be replaced. Contemporary systems provide added functions of use, replacement statistics, and balance the inventory across the district based on needs.
9.5 Support Services Systems

A third division of systems is referred to as ‘supporting systems’, or silos of information necessary for the operation of specific departmental needs yet not fully integrated with either the business systems or the instructional systems. The district is currently upgrading and replacing existing systems and needs to plan for the interoperability of all applications.

9.5.1 Food Services

There is no doubt that a standardized application for food services is significant and beneficial. The district has recently completed a successful pilot for a centralized food services application and is in the process of upgrading all school facilities to this system. One major concern is the systems ability to integrate with existing district-wide applications. An effective and successful solution will integrate with both the Student Information System and the General Ledger, thus eliminating double data entry and minimizing the risk of errors. Because the Food Service system is frequently the district’s location for free and reduced lunch information, it becomes a component of the district’s NCLB reporting requirements and e-rate calculations. Integrating the Food Service application with the districts other major applications will facilitate NCLB reporting and e-rate applications.

9.5.2 Transportation

By increasing the number of students eligible to ride busses, a major goal for the district to increase state reimbursements could also be met. Currently, the Transportation Office utilizes two primary applications—COMPASS for vehicle maintenance and EDULOG for school bus routing. EDULOG receives key student data from ISIS and returns data to ISIS. The system is therefore dependent on schools for accurate data. Automated methods need to be developed and implemented to record student ridership.

9.5.3 Utilities, Security, and School Safety

The Energy Management and Security System (EMS) coordinates environmental data and security communications centrally through both dial-up lines and by utilizing the LAN and WAN. In addition, there is a closed circuit television (CCTV) network that is monitored by security personnel throughout the day and records video during the off hours. The district needs to explore the feasibility for utilizing IP Cameras to centrally store and monitor video over the district WAN. Upgrades to the system can be paid for through grants such as Safe Schools or even Homeland Security.
9.5.4 Facilities and Construction Maintenance

M-DCPS is in the process of installing an updated capital planning system to provide needed functions.

9.5.5 Facilities and Maintenance Operations

The district utilizes a system called COMPASS to support the maintenance functions in the district, including work-order tracking, parts, inventory control, and transportation maintenance. The department has done an exceptional job at exporting the data into the data warehouse. The Facilities department is exploring applications for Product Life Cycle Management (PLM) for specific parts of schools. A new system is needed in this area.

9.5.6 Inventory Management

The methodology used to manage assets is often called the asset life-cycle methodology. The asset life-cycle methodology is comprised of four phases:

- Planning—Planning of inventory includes both strategic and operational planning. During strategic planning the requirements of the district are defined and articulated. This allows the operational planning activities to focus on how the strategic plan is to be implemented.
- Acquisition—Acquisition addresses the activities necessary to establish and replenish inventory levels consistent with those defined by the strategic plan.
- Stewardship—The activities necessary to track and maintain the inventory in a fit-for-use status are categorized as stewardship.
- Disposition—The strategic plan defines the purpose and useful life of the asset. At the conclusion of its useful life, the inventory is released for other use or for exit from the district.

Inventory Planning

Inventory management begins with planning. Planning provides the context for developing an inventory management mission and its attendant goals and objectives, which are the fundamental drivers of all inventory management efforts. The more demanding the inventory management mission, goals, and objectives, the more important it is to associate them with the district’s mission, goals, and objectives.
Inventory Acquisition

Clearly, data have to get into the system; but to reduce errors, data will be entered only once if possible, with allowances made for later corrections. The first time an inventory item is recognized, it should be coded so that subsequent inputs of that item’s information can be automated. Bar coding is an efficient and effective method of accomplishing this automation.

Active participation by the purchasing application is vital to inventory management. It is from the purchasing system that all inventory enters the system. At this time the purchase order information is recorded in the inventory database. The purchase order is also recorded for any addition of features or of maintenance agreements during the life of the asset. The purchase order is the index by which much of the information relative to an individual item is accessed.

Stewardship

The inventory management application provides for recording such activities as moving the item from one location to another, recording physical inventory activity, assessment of fit-for-purpose of inventory items, or disposal at the end of the item’s life.

- **Moving of inventory** from one location or use to another requires that the inventory database be updated. The items are updated and the rules and plan are referenced.

- **Changes to the equipment**, such as the addition or removal of features, requires the updating of the inventory database. Additionally, the purchasing database must be updated to reflect that the feature has not only been received but installed as well.

- **Fit for purpose evaluations** are performed on numerous occasions during the life of an inventory item. These evaluations could be the result of maintenance and repair or the result of changes in the standard for performance. When these events occur, the inventory database must be updated.

- **Physical inventory** occurs on a scheduled basis or as an ad hoc audit. In either event, when discrepancies exist between the inventory database and the physical count of the inventory, the inventory database must be updated.

Disposition

Disposition occurs for a number of reasons including end of life or failure. Disposition cannot take place until consideration is given to Florida Statutes Chapter 274[] (Tangible Personal Property Owned by Local Governments). Once these external considerations are satisfied, the M-DCPS considerations can occur.
At this time the item is removed from the inventory database and the purchasing database is updated. Under some circumstances an item may be eligible for disposal in its current purpose and yet have value if reassigned to another purpose. Therefore, it is desirable to investigate the suitability of this item for other purposes before disposition. This requires the ability to query the planning data to identify possible alternative uses for the item under consideration for disposition.

9.6 Decision Support Systems

The research and best practice information in the following section supports recommendation ADS-6: Obtain Licenses for Easy-to-use Query, Analysis, Reporting, and Dashboard tools.

The Decision Support System is the framework for integrating data from multiple applications and facilitating decision making using the assembled data. Reporting and analyzing data on all aspects of a problem results in more comprehensive, accurate, and timely decisions. (Decision Support and techniques for achieving it such as data warehousing should not be confused with Systems Integration. Data warehousing is a tool to facilitate decisions through the analysis of data. The goal of systems integration is to streamline operational efficiencies.)

9.6.1 Decision Support Framework

Systems Architecture

An effective architecture for decision support for improving and sustaining academic performance and organizational effectiveness is comprised of two key elements:

- An applications architecture of databases and technology tools that comprise the information systems necessary for instructional improvement and organizational effectiveness efforts.
- Enabling processes that include those business, policy, staff development, communication, and organizational processes necessary for the technology to be used effectively.

The application architecture can be considered the hard element of the architecture. It provides the technology (databases, computer applications, network and server infrastructure, etc.) to support the enabling processes for each component. The enabling processes can be considered the soft element of an overall architecture. It is critical that this element be properly defined and implemented for all components (see below) of the overall architecture.
Architecture Components

Most ERP systems include a comprehensive decision support system for financial and human resource subject areas; however, they do not address instructional improvement. The components of an effective architecture for decision support for instructional improvement include:

- academic standards – a process to identify, define, refine, communicate and monitor the state’s standards for learning by subject and grade
- curriculum – a process to identify and communicate the proper curriculum and material that supports the standards that are defined
- performance based and standardized assessments – a process to define the performance criteria that should be achieved by students as it relates to the standards and a method to assess and report each student’s progress relative to the criteria
- data-driven intervention and analysis – a process of collecting and analyzing assessment data to identify and conduct interventions at the school, classroom, and student level to ensure students achieve the highest possible performance
- teacher certification – a process to establish teacher competency levels as related to the state standards and to certify teachers who have achieved the proper level of competency
- accountability – the process of defining expected performance levels for districts, schools and teachers, and of holding districts, schools, and teachers accountable for achieving these levels, with the appropriate rewards provided for success
- classroom and instruction management – the process of managing the classroom and the instruction that is to be delivered (as defined by the curriculum process) and monitoring the effect on student performance
- student data collection and reporting – the process of collecting student data from the classroom, school, and district relative to all aspects of student information

Enabling Processes

All of the above components are linked with each other and with the financial and human resource subject areas and are supported by enabling processes which include:

- policy – objectives and processes established by the legislature to determine the type of outcomes that are desired in the state
- staff development – training of staff so that they are capable of using the technology and understanding the processes associated with improving academic performance
• communication – the process of providing information to the district, community, parents, and key business stakeholders relative to student achievement and the curriculum that is available to assist them
• business process – managing business processes to create clearly defined procedures, role descriptions, measures, and technology-based systems to ensure efficiency and effectiveness
• organization/staffing – ensuring that the proper organizational structure and staffing are in place to support the components
• funding/grants – ensuring that funds and grants are provided to implement and support the components at the state- and district-level

The applications architecture (databases, applications, and infrastructure) and the enabling processes are integrated so that there is a comprehensive system comprised of the hard and soft elements within each of the components.

9.6.2 Data Warehouse

Until the advent of data warehouses, enterprise databases were expected to serve multiple purposes, including online transaction processing, batch processing, reporting, and analytical processing. In most cases, the primary focus of computing resources was on satisfying operational needs and requirements. Information reporting and analysis needs were secondary considerations. As the use of PCs, relational databases, 4GL technology and end-user computing grew and changed the complexion of information processing, more and more business users demanded that their needs for information be addressed. Data warehousing has evolved to meet those needs without disrupting operational processing.

In the data warehouse model, operational databases are not accessed directly to perform decision support research. Rather, they act as the source of data for the data warehouse, which is the information repository and point of access for information processing.

M-DCPS has created a data warehouse that brings data from many of its legacy systems, including financial, human resource, and student, into a single database repository. The district utilized the best practices and approaches described in this and subsequent sections.

Data Warehouses can be defined as subject-oriented, integrated, time-variant, non-volatile collections of data used to support analytical decision-making. The data in the warehouse comes from the operational

environment and external sources. Data Warehouses are physically separated from operational systems even though the operational systems feed the data warehouse with source data.

The primary objective of data warehousing is to bring together information from disparate sources and put the information into a format that is conducive to making decisions. This objective necessitates a set of activities that are far more complex than just collecting data and reporting against it. Data warehousing requires both business and technical expertise and involves the following activities:

- accurately identifying the information that must be contained in the warehouse
- identifying and prioritizing subject areas to be included in the data warehouse
- managing the scope of each subject area which will be implemented into the warehouse on an iterative basis
- developing a scaleable architecture to serve as the warehouse’s technical and application foundation and identifying and selecting the hardware/software/middleware components to implement it
- extracting, cleansing, aggregating, transforming, and validating the data to ensure accuracy and consistency
- defining the correct level of summarization to support decision making
- establishing a refresh program that is consistent with district needs, timing, and cycles
- providing user-friendly, powerful tools at the desktop to access the data in the warehouse
- educating the business community about the realm of possibilities that are available to them through data warehousing
- establishing a data warehouse help desk and training users to effectively utilize the desktop tools
- establishing processes for maintaining, enhancing, and ensuring the ongoing success and applicability of the warehouse

Architecture review and design develops a long-term strategy for development and refinement of the overall data warehouse and is not conducted merely for a single iteration. This stage develops the blueprint of an encompassing data and technical structure, software application configuration, and organizational support structure for the warehouse. It forms a foundation that drives iterative detail design activities. Where design tells the user what to do; architecture review and design informs the users about what pieces are necessary to accomplish it.
Data warehouse architectures are composed of conceptual, logical, and physical views reflecting different levels of abstraction, as shown in Figure 9-2 below.

![Diagram of Data Warehouse: Conceptual, Logical, and Physical Architecture](image)

A data warehouse logical architecture includes the following components:

- enterprise data store—a central repository that supplies atomic (detail level) integrated information to the whole organization
- operational data store—a snapshot of a moment in time's enterprise-wide data
- one or more individual data marts—summarized subset of the enterprise's data specific to a functional area or department, geographical region, or time period
- meta-data stores or repositories—catalog(s) of reference information about the primary data. Metadata is divided into two categories: information for technical use and information for business end-users

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Once the logical configuration is defined, the data, application, technical, and support architectures are designed to physically implement it. Requirements of these four architectures are carefully analyzed so that the data warehouse can be optimized to serve the users. Gap analysis is conducted to determine which components of each architecture already exist in the organization and can be reused, and which components must be developed or purchased and configured for the data warehouse.

### 9.6.3 Web-accessible Query, Analysis, and Reporting Tools

Creation of a data warehouse, which brings data from many different legacy systems (including financial, human resource, and student systems) into a single repository, does not necessarily result in a decision support system useful to a large number of users. The data warehouse does make creating reports easier for programmers, but not to users in finance, human resources, and student services.

Districts need an easy-to-use Web-based tool for users to query, analyze, and report against the district data stored in the data warehouse. Such a tool is essential to turn a data warehouse into a system for decision support. The tool can be used to:

- create departmental and school dashboards where key performance indicators are tracked and updated daily
- enhance analysis of FCAT and other indicators of student achievement to identify specific areas of weakness in instruction and instructional delivery, allowing interventions to be developed and monitored to ensure the interventions’ effectiveness
- allow longitudinal analysis of student test scores, departmental or district-wide spending, and personnel data in graphical and tabular forms, with the ability to drill down on specific summary data to see the details

The query, analysis, and reporting tool will allow users in finance, human resources, and student services to analyze data in new and creative ways, respond to specific questions from management and the board, and make information available to their departments and the broader community.

The vast majority of people will use reports created by a relatively small group of people. It is not expected that every teacher and administrative assistant will be able to create his/her own reports from scratch without training. However, he/she will be able to access information in ways that are meaningful and useful. A typical installation will include sets of “parameterized” reports. These standard reports allow the user to set selected parameters and create a report. For example, a standard attendance report might have settable parameters like date and grade level.
9.6.4 Data Warehouse as Transition Strategy

When a district’s major administrative systems are old and need to be replaced, the creation of a data warehouse should be considered a best practice to facilitate access to the legacy data.

A data warehouse is also a best practice to minimize the impact of transitioning from legacy applications to new ones. The data warehouse allows most users to access the information they need. During the transition, the legacy applications will be shut down and the new applications will provide data to the data warehouse. The users will continue accessing the data warehouse even though the source systems have changed. The data warehouse will thus insulate the vast majority of users who simply need information.
10.0 COMMUNICATIONS AND NETWORK INFRASTRUCTURE

Included in the Technology Blueprint are a number of Major Recommendations. The purpose of this section is to provide a summary of the research and best practices information available to support the recommendations. The major recommendations related to Communications and Network Infrastructure are:

- CNI-1: Complete the Native Mode Lan Interconnect (NMLI) project
- CNI-2: Centralize management of wireless networks
- CNI-3: Update Construction and Cabling Specifications for Data Infrastructure
- CNI-4: Implement IVR with Exploration for Integration
- CNI-5: Acquire Additional Capacity and Redundancy for Internet Access
- CNI-6: Implement Voice over IP and Video Conferencing in Network
- CNI-7: Plan and Implement Integrated Network and Digital Broadband Wireless Network
- CNI-8: Resize Mainframe
- CNI-9: Develop Central Network Attached Storage and Offer Service to Schools

In support of these recommendations, the following information presents current research and best practices for the topics covered in Chapter X—Communications and Network Infrastructure. To facilitate navigation of the information in this section, the following is a table of contents for this section:

- Strategic Issues
  - Methods for Effective Planning and Plan Utilization
  - Network Design Strategies
  - Characteristics of High-performance Networks
  - Convergence in the Digital Age
  - Models for Computing and Communication Networks
  - Capacity Planning
  - Strategic Management of Technology
  - Total Cost of Ownership
  - Equity of Connectivity

- Emerging Issues
  - Wireless Networking and Hybrid Networking
  - Web-based Resources
  - Collaboration
This chapter presents information on the best practices for the topics covered in Chapter X – Communications and Network Infrastructure. These topics include:

- Strategic Issues
- Emerging Issues
- Data Infrastructure
• Communications Infrastructure
• Computing Infrastructure
• Network and Information Security

In addition to nationally researched approaches, the current work of the M-DCPS and the state of Florida are reflected in this body of knowledge.

10.1 Strategic Issues

The research and best practice information in the following section supports recommendation CNI-1: Complete Native Mode LAN Interconnect (NMLI) project.

The following topics provide a strategic framework for development of an effective computing, communication, and network infrastructure.

10.1.1 Methods for Effective Planning and Plan Utilization

Planning is the essential means to determine the direction for the future as well as to make equitable and optimal use of available resources. A plan is a combination of vision and action, bringing together goals, resources, roles, and tasks over a defined period of time. In most cases, three years in a rolling cycle of renewal is an adequate period for planning as it gives direction and at the same time permits inclusion of emerging technologies. A plan gives coherence to actions and enhances the efficient use of resources.

A plan, however, can also become stagnant and irrelevant. Both the technology and the uses have the potential to change more rapidly than the plan if it is not fixed in time. For this reason, it is critically important to develop a document and associated process for renewal that makes accommodation of new technology, new applications, and new functions an integral part of periodic review and re-development. The plan must provide both a vision for long-term direction and plans for implementation of initiatives in the short-term, each aligned to support the vision.

In addition to planning the implementation of technology, it is necessary to include plans for funding the maintenance, support, and training required to assure that the technology is utilized to its potential.


Planning Process

The overall IT Blueprint planning process is covered in Chapter IX but the following steps form the foundation for planning infrastructure systems implementation:

- step 1: create an infrastructure systems steering committee
- step 2: identify the services and service levels required over the next three to five years
- step 3: research relevant issues and create technical foundation
- step 4: survey, catalogue and assess current systems
- step 5: build a plan with clear technical and financial objectives
- step 6: implement and institutionalize the plan.

Successful creation and implementation of a plan starts with visionary leadership from administrators and board members. Visionary leaders understand the concept of infrastructure systems implementation and the related themes about the implementation of technology systems:

- change and the change process
- planning and budgeting
- staff development
- technology infrastructure architecture
- specialized technical support
- the needs of technology–integrated curriculum delivery
- the need for technology champions.

Lack of effective planning is generally the largest stumbling block facing district- and building-level planning for infrastructure systems. This is generally attributed to:

- lack of clear requirements for the use of technology in teaching, learning and administration
- ill-defined hardware and software acquisition policies
- lack of technology line items in the district's budget
- lack of a systems and services approach to infrastructure implementation
- lack of effective champions for technology implementation
Collaboration

Effective infrastructure planning requires collaboration among many groups spanning the entire organization—groups that have distinct charters and agendas, but which share a common goal: ensuring that the infrastructure supports mission-critical applications and communication throughout the district.

Constituents involved in the infrastructure planning effort include strategic managers (executive and service level managers) responsible for establishing the objectives for performance and the tacticians (capacity planners and technicians) who are responsible for achieving those goals.

Each of these groups requires different levels of network performance history to assess the impact on his/her area of responsibility. For instance, executives and managers demand high-level summaries of performance so they can see the impact of the network on their applications and ultimately on operations. Capacity planners seek insight into how past performance can predict future and recurring usage so that they can intelligently provide sufficient capacity and functionality to support demand while minimizing expenditures. Technicians need detailed performance data to resolve performance issues. Service level managers must monitor key service level agreement (SLA) metrics to ensure that the infrastructure is not only meeting the needs of the district, but also verifying that service providers are complying with their SLAs.
Table 10-1: Functions of Infrastructure Planning Roles

<table>
<thead>
<tr>
<th>Function for Infrastructure Management</th>
<th>Objectives</th>
<th>Measured On</th>
<th>Planning Horizon</th>
<th>Reporting Needs</th>
<th>Report Granularity</th>
<th>Key Metrics</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executives</td>
<td>Ensure network is meeting district goals and objectives</td>
<td>Ability of infrastructure to meet district goals and objectives</td>
<td>3-to-12 months and longer</td>
<td>High-level overviews</td>
<td>Months</td>
<td>Availability and downtime; total costs</td>
<td>How to manage growing IT expenditures</td>
</tr>
<tr>
<td>Managers</td>
<td>Ensure compliance with service level agreements</td>
<td>Ability to meet agreed to service levels</td>
<td>1-to-6 months</td>
<td>Weekly and monthly metrics on service level agreements</td>
<td>Months, Weeks</td>
<td>Carrier costs; availability</td>
<td>Selecting the best carriers to meet customer service level agreements</td>
</tr>
<tr>
<td>Planners</td>
<td>Intelligently plan and anticipate capacity needs</td>
<td>Expenditures and the ability to minimize the impact of change</td>
<td>3-to-12 months</td>
<td>Long-term trending</td>
<td>Months</td>
<td>Projected utilization; usage</td>
<td>Balance expenditures against district needs</td>
</tr>
<tr>
<td>Technicians</td>
<td>Minimize downtime and facilitate change</td>
<td>Mean-time-to-restore service</td>
<td>1 day to 1 month</td>
<td>Detailed performance reporting</td>
<td>Days, Hours, Minutes</td>
<td>Congestion; error statistics</td>
<td>Simplifying fault detection, isolation and resolution</td>
</tr>
</tbody>
</table>

10.1.2 Network Design Strategies

Most IP intranets fall into one of two categories: those that have been designed and those that have been pieced together over time. The perceptible difference between these two types of networks illustrates the importance of good design. Intranets that began with a comprehensive design operate much more efficiently than those that grew to meet changing demand.

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Design Objectives

It is imperative to set clear design objectives at the outset of the design process. By what parameters will designers, users or customers evaluate the infrastructure design? ITS will negotiate a wide range of service level agreements for performance and availability with its customers (schools, departments, etc.). This will establish the targets for the design.

Once the targets are set, the designers must identify all factors that influence meeting the service level targets. For example, what is the bandwidth consumption associated with an application? We will need to evaluate this to provide the capacity necessary to meet performance targets. How about the application's sensitivity to packet loss, packet delay and variation in delay? This is particularly important on modern IP networks that support multiple heterogeneous applications. Data applications that employ UDP transport are more seriously affected by packet loss than reliable connection-oriented TCP-based applications. Conversely, real-time applications such as voice, video, and multimedia tolerate packet loss better than they do delay and variations in delay. Thus, the different network applications may require us to give priority to different quality parameters. Various tools and techniques exist to deploy Quality of Service in the network core and the edge. This management control is becoming more of a necessity than a luxury with the emergence of voice and video applications and services over the traditional IP network.

We will also establish target values for network availability and downtime. This target, like the performance targets, serves as a quality benchmark during the design process. The tolerable level of network downtime is heavily related to the nature of the applications being used. The effect of application unavailability can vary from inconveniencing a few people to changing the lesson plans for tens of thousands of students if the Internet is down.

We will need to estimate the scale to which the network is likely to grow. This should entail projected growth estimates for the number of students, classrooms, schools and, arguably most important, growth in existing and new application traffic. Our network plan must serve to accommodate this growth.

Designing the infrastructure to the performance, resilience, and scalability specifications is of little use if it is not also cost-effective. Infrastructure designers must be keenly aware of budgetary constraints to make intelligent cost-versus-capability trade-off decisions.
Network Design Principles

Several key principles are essential to successful network design. Many of the poorest network implementations stem from the fact that these network design principles were not observed.

- Applications drive the design requirements: The network is the structure that facilitates the applications. We cannot effectively design a network without understanding the applications’ characteristics and their requirements.

- Network design requires experienced personnel: The network design engineer requires broad, practical experience combined with a theoretical understanding of the technologies and the way they relate to one another. Extensive practical experience will need to be seen as a necessary prerequisite to a design role. We cannot design a network without a reasonable understanding of how it operates.

- Networks are designed in a lab rather than on paper: Thus, a lab is the single most important design tool. Given the complexity of the more advanced inter-network designs, a design is not valid until it has been verified in the lab.

- Network modeling software is also not to be trusted. Inter-networking entails a multitude of complex technologies that must successfully interact with each other. Large or complex networks cannot be reliably modeled except at a very high level. Resolving specific technical detail requires lab work.

- Network design usually involves a number of trade-offs: Cost versus performance and reliability is usually the fundamental design trade-off. Figure 10 shows the fundamental trade-offs among performance, reliability, and cost. Designers must balance the conflicting design goals. They can design a system that is fast and reliable, but it will not be cheap. Alternatively they can design a system that is cheap and reliable, but it will not be fast.
Do not automatically mirror the district’s organizational structure in the network design: Such an approach can result in fundamentally flawed designs. We need to keep in mind that the design objectives are the only essential driving force behind the design.

Maintain vendor independence: Proprietary solutions seldom represent the best choice, but neither should we automatically avoid them. In some cases, dominant vendors can provide the best solution to a particular network problem.

Endeavor to keep it simple: Unnecessary complexity will likely increase support costs and makes the network more difficult to manage. Thus, we'll always try for the simplest viable solution. Increased complexity is only justifiable if there is a related benefit or requirement.

Endeavor to design every network on its own merits and not work to a set of rigid and possibly over-generalized design rules or templates. We will need to consider every network on its own merits and avoid copying existing designs simply because the networks appear similar.

Use only mature and well-tested software and hardware for all devices on the network.

Design the network properly at the outset. If the network design is not robust, such everyday tasks as troubleshooting and adding new devices to the network will become design projects in themselves. Without a valid design, basic network changes do not form part of any plan and will be treated as isolated projects.
There is no predictability, so we'll need to assess independently the effect of any changes on the network if we deviate from the design plan. This is what designing a network a thousand times means.

- Do not compromise the fundamental design plan. The design may have to bend and evolve with the network, particularly to ensure scalability, but this doesn't mean it can be compromised at a fundamental level. If we repeatedly compromise the original design for the sake of quick fixes, at some point the design becomes unstable. A network design is merely an academic exercise if it is not fully and precisely implemented as per the original design plan. M-DCPS will not make changes to the original design without the endorsement of the engineers who formulated that design.

- Predictability is the hallmark of a good design: A well-designed network will bring predictable and consistent performance, resilience, and scalability.

- Design requires a small capable team. No one person, no matter how skilled or experienced, will be the single and absolute authority in designing the network. Designing a network involves balancing priorities, performing trade-offs, and addressing a broad range of technical issues at both a general and a detailed level. A design team needs people with different specialties and strengths: some may focus on the general while others may be sticklers for the specific details.

10.1.3 Characteristics of High-performance Networks\(^4\)

**Infrastructure Requirements**

Different applications require different infrastructure characteristics in terms of throughput, availability, delay, jitter, and packet loss in order to make the user experience acceptable. Unacceptable network delays for applications, such as for Virtual Counselor, student use of instructional learning systems, or SAP transactions, can hamper the goals and productivity of the district. Hence, a thorough understanding of application requirements and projected traffic growth are crucial to designing scalable networks with built-in future proofing.

Embracing new technologies such as IP Telephony and e-business/e-learning integration requires the network to be able to discriminate between these different types of traffic and dynamically configure its behavior to meet the traffic requirements. This has led to the deployment of "differentiated services" in infrastructure networks. For example,

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network throughput, packet loss and latency are important considerations for instructional and administrative applications. For multimedia and real-time voice applications, minimizing network latency and jitter become critical considerations.

To help achieve high-availability networks, M-DCPS will incorporate intelligent network services into switches, routers and other network equipment. These services deliver high network uptime with high performance for mission-critical applications. High-availability services include:

- quality of service prioritization
- IP telephony prioritization
- scalable management
- multicast
- traffic storm control
- security
- spanning tree enhancements
- VLAN spanning tree optimization

**Characteristics of a Well-Designed Network**

A network that has been well designed will be predictable and consistent in each of the following areas:

- **Performance**
  
  A well-designed network shows consistently high performance in application response time, the variation in response time and other performance parameters.

- **Resilience**
  
  The network should provide a resilient platform for the applications it supports. A well designed network might have to meet an availability target of 99% for all applications with a zero-downtime requirement for mission-critical applications. Ideally, the failure of any one link or networking device along the client-to-server path should not result in the loss of a client-server session. Automatic failover to an alternate path should occur within a short time interval. This interval is called the convergence time and can be defined as the span between a network topology change (such as the loss of a link) and each device on the network becoming aware of the change. Well-designed networks are characterized by consistently low convergence times.
• Scalability

A scalable network can support growth without having to be radically redesigned. It can handle both the addition of users, network nodes or sites, and the addition of new applications with increased bandwidth needs.

To get a feeling for how scalable the network is, ask the following question: What if our network had to serve twice the number of users, twice the number of nodes or new applications that demanded twice the bandwidth? A scalable network can accommodate this growth without significant changes to its overall design.

One should not have to redesign the fundamental network topology or the technology used to accommodate growth. New nodes and users can be added to a scalable network in a simple building-block approach. Adding new nodes, for example, should simply entail the addition of a new section or block to an existing structure that serves as the core or backbone of the network. To accommodate increased bandwidth demands, you should be able to appropriately augment the LAN and WAN bandwidth as necessary.

Certain operational upgrades, such as increased memory and processing power on the network routers and switches, may also be required during the network lifetime. However, none of this should require a radical overhaul of the network infrastructure to support projected growth during the network's lifetime. This is, after all, one of the fundamental reasons why one deploys a network plan to begin with.

• Costs

Cost is the most fundamental driver behind the network-design process. Networks must not only meet a certain technical specification but must also be cost-effective in their implementation and operation. The primary cost component of a network is usually the service provider charges for connecting among the sites and to the outside world.

Network designs typically trade off cost versus performance and availability. For example, we may need more bandwidth to ensure optimum application performance. However, there is usually a cut-off point where purchasing more bandwidth is no longer cost-effective. Similarly, back-up circuits may be required to ensure resilience along the client-to-server data path in the event of a failure on the primary data path. This back-up technology must be
comparable in speed to the primary link to avoid degraded service when the primary connection is down. We must decide whether or not degraded service is tolerable during a fault scenario.

A well-designed network will not only be cost-effective to implement; it should also have relatively consistent operating costs. A well-designed network minimizes the support costs. The second largest cost of owning a network (after WAN costs) is the cost of support. It is also the most overlooked cost element, mainly because it is notoriously difficult to quantify. For example, we could decide to install and manage our own fiber network to reduce the WAN costs that would be incurred from a service provider. While this would undoubtedly reduce WAN costs, it would also result in increased support costs. A significant level of expertise is required to support a private fiber network; hiring and retaining such expertise is expensive. However, without such expertise in-house, the cost of network support will likely be even greater because of the need for external consultants and other third parties to fill the gaps and ensure smooth daily operations.

10.1.4 Convergence in the Digital Age

Convergence refers to the power of digital systems to combine voice, video, data, text, and money in new applications, devices, and networks.

Over time, separate networks have been built for data, voice, and video applications. These have been separately deployed and operated in isolation, often implemented and managed by separate groups.

The networks have been built using different technologies: dedicated leased lines for PBX and conferencing; Instructional Television Fixed Service (ITFS) and coax for television, and a combination of leased lines, Category 5 wiring, fiber, and numerous devices for data. Additionally, in many schools separate systems exist for paging and public address, building systems control, security, surveillance, and clocks among others.

This use of different approaches for each application transport is extremely inefficient. At this time, the volume of data traffic is growing faster than that of voice and other services, driven by emerging and evolving technological innovations such as the World Wide Web, e-commerce and applications such as videoconferencing or video streaming utilizing IP multicast. While growth rates vary by country and carrier, it is certain that data transport will dominate telephony networks. Data has already surpassed voice on most U.S. service provider

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networks. It is the driving force behind global network growth. The challenge for the enterprise is to optimize networking to carry data, voice, and video traffic in addition to control and communication signals from other systems.

It is widely accepted and acknowledged by the communications industry and industry analysts as a whole that the Internet Protocol (IP) will become the universal transport of the future. The rapid adoption and migration of vendors to the utilization of IP as a transport for data, voice, and video applications further endorses this transition to a converged networking paradigm. The message is clear: move towards IP or risk being left behind.

Utilizing IP as the ubiquitous transport offers the enterprise significant statistical gains in bandwidth efficiency, lower overall bandwidth requirements, ease of management and the ability to deploy new applications rapidly. Once all network traffic utilizes the same transport protocol, all systems can share the same network infrastructure.

By using IP, the number of local and district-wide systems is reduced as is the number of devices required to terminate those facilities. Bandwidth can be added incrementally and shared between applications, adding efficiency and reducing complexity. When voice is quiescent, data can use the available bandwidth; when voice or video applications are active, they can be guaranteed the bandwidth they require. Converged networks are a continuing trend, and this consolidation of data, voice, and video is the natural evolution for multi-service networking.

The use of IP as the transport protocol of the converged applications does not dictate a particular WAN or LAN technology. IP can be broadcast using the district's ITFS frequencies or transported over wires or fiber to the schools. Within the building, IP can be delivered over wireless or wired networks. In most cases it will be advantageous to use multiple transport systems for flexibility and to maximize availability.

Open Standards-based Architecture

Fundamental to the success of converged networks is the use and adoption of open standards as they emerge and mature. Every effort will be made to ensure that the equipment, applications, and protocols integrate and operate seamlessly.

Examples of these protocols include the existing and emerging standards-based protocols for call control: H.323, the Simple Gateway Control Protocol (SGCP), the Media Gateway Control Protocol (MGCP), and the Session Initiation Protocol (SIP). The above are already standards or are in the process of being ratified as standards and are all designed to provide call control for media gateways such as routers and switches.
Further examples of open standards currently being adopted by the telecommunications industry are the Telephony Application Programmable Interface (TAPI) and the Java Telephony Application Programmable Interface (JTAPI). These protocols are used to communicate between applications to delivery IP PBX functionality and unified messaging. This open and standards-based interface model is in direct contrast to the proprietary interfaces of legacy PBX equipment.

The use of open standards and the promotion of multi-vendor collaboration and interoperability are a key benefit of a converged network architecture. The architecture creates an environment that fosters competition; this, in turn, lowers prices for services, systems and equipment. It also allows the integration of products from multiple vendors to create a customized solution. No single vendor can provide a solution that fits all requirements for data, voice, and video. Often specialized applications are designed and implemented only by a single company and need to be integrated with the overall solution. The adoption of open standards creates an ecosystem that actively promotes a model of integration.

The rapid innovation is possible because the applications run over a converged network. Applications can be written independent of operating system and connectivity. Compatibility with any other IP-based applications is assured. Contrast this to an application-requiring integration with a legacy PBX where the architecture is closed and proprietary, stifling innovation and increasing costs.

Other examples include deployment of surveillance and communication system throughout buildings with central control.

**Manageability**

A manageable networking architecture is based upon five building blocks: intelligent network, policy services, registration, directory services, and policy administration.

**Reduction of Cost**

While data networking has evolved to open, distributed, standards-based systems, the telephony infrastructure has changed little in the past 20 years and those economies and efficiencies associated with open standards and competition have been impossible to attain. Once a PBX vendor has been selected and the product implemented, the proprietary and closed architecture of that PBX effectively prevents multi-vendor interoperability at anything other than basic levels. This has kept the price per port of PBX systems relatively flat for recent years and also shackled customers to the PBX vendor.
If we contrast the above to data networking, the picture is very different. Moore's Law has demonstrated that the price / performance of semiconductors double every 18 months. These savings have caused the cost of data networking equipment to fall rapidly over time while performance has increased exponentially. These benefits translate into reduced prices for M-DCPS.

Other factors that lower costs include the reduction of wide-area facility requirements, fewer devices to manage and maintain, and simpler moves, additions, and changes. These result in a lower training and staffing cost associated with a simplified and converged infrastructure.

### 10.1.5 Models for Computing and Communication Networks

M-DCPS is in the process of implementing significant upgrades in speed to the schools through a project known as the Native Mode LAN Interconnect (NMLI). NMLI is a product of Bell South and offers the school many of the benefits of a well-designed network, most notably performance, resilience and scalability.

**The New 80/20 Rule**

The conventional wisdom of the 80/20 rule underlies traditional design models. This model assumes that 80% of the traffic stays on site. The remaining 20 percent of the traffic leaves the school through a router connected to the WAN. The traditional 80/20 traffic model arose because each school or work group had one or more local servers on the LAN. The local servers were used as a file server, logon server, and application server for the school or work group.

The 80/20 traffic pattern has been changing rapidly with the rise of intranets and applications that rely on distributed IP services. Many new and existing applications are moving to distributed World Wide Web (WWW)-based data storage and retrieval

The traffic pattern is moving toward what is now referred to as the 20/80 model. In the 20/80 model, only 20 percent of traffic is local to the site LAN and 80 percent of the traffic leaves.

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The Multi-layer Switching Model

The performance of multi-layer switching matches the requirements of the new 20/80 traffic model. The two components of multi-layer switching include multi-protocol routers and Layer 3/2 switching in hardware. It is important to note that there is no performance penalty associated with Layer 3 switching versus Layer 2 switching.

The district network includes buildings connected by a backbone called the core. The distribution layer consists of multi-layer switches (see Figure 10-3). The multi-layer design takes advantage of Layer 2 switching performance in the access layer and backbone and uses multi-layer switching in the distribution layer. The multi-layer model preserves the existing logical network design and addressing as in the traditional hub and router model. Access-layer subnets terminate at the distribution layer. From the other side, backbone subnets also terminate at the distribution layer. So the multi-layer model does not consist of district-wide VLANs, but does take advantage of VLAN trunking.

Figure 10-3: Multi-Layer Switching
Because Layer 3 switching is used in the distribution layer of the multi-layer model, this is where many of the characteristic advantages of routing apply. The distribution layer forms a broadcast boundary so that broadcasts don't pass from a building to the backbone or vice-versa.

The greatest strengths of the multi-layer model arise from its hierarchical and modular nature. It is hierarchical because the layers are clearly defined and specialized, and modular because every part within a layer performs the same logical function. One key advantage of modular design is that different technologies can be deployed with no impact on the logical structure of the model. For example, FDDI can be replaced by switched Fast Ethernet. Hubs can be replaced by Layer 2 switches. Fast Ethernet can be substituted with Gigabit Ethernet and so on. So modularity makes both migration and integration of legacy technologies much easier.

Another advantage of modular design is that each device within a layer is programmed the same way and performs the same job, making configuration much easier. Troubleshooting is also easier because the whole design is highly deterministic in terms of performance, path determination, and failure recovery.

In the access layer, a subnet corresponds to a VLAN. A VLAN may map to a single Layer 2 switch, or it may appear at several switches. Conversely, one or more VLANs may appear at a given Layer 2 switch. VLAN trunking can provide flexible allocation of networks and subnets across more than one switch. Multiple VLANs can be served per switch to achieve load balancing and fast failure recovery between the access layer and the distribution layer.

With the NMLI project, M-DCPS will be able to map 802.1Q VLAN traffic between buildings over the WAN. This was not possible before and higher layer protocols such as IP based VLANs would have to be utilized. This does not change the modular layer approach. Rather, it simplifies and enhances what can be done by extending the LAN and removing the complexities associated in the WAN layer.

In its simplest form, the core layer is a single logical network or VLAN, a simple switched Layer 2 infrastructure with no loops. It is advantageous to avoid spanning tree loops in the core. Instead, we will take advantage of the load balancing and fast convergence of Layer 3 routing protocols, such as OSPF and/or Enhanced IGRP to handle path determination and failure recovery across the backbone. All the path determination and failure recovery is handled at the distribution layer in the multi-layer model.

In a switched Ethernet WAN environment such as being installed in M-DCPS, it is more efficient to implement Ethernet Automatic Protection Switching (EAPS) or Fast Spanning Tree Protocol (FSTP) at layer 2 where <50 millisecond convergence is realized.
Redundancy and Load Balancing

A distribution-layer switch could represent a point of failure at the building level. One thousand users in Building A could lose their connections to the backbone in the event of a power failure. If a link from a wiring closet switch to the distribution-layer switch is disconnected, 100 users on a floor could lose their connections to the backbone.

Multi-layer switches can be interconnected to provide redundant connectivity within a domain. Redundant links from each access-layer switch connect to distribution-layer switches. Redundancy in the backbone is achieved by installing two or more switches in the core. Redundant links from the distribution layer provide failover as well as load balancing over multiple paths across the backbone.

Redundant links connect access-layer switches to a pair of multi-layer switches. The two distribution-layer switches cooperate to provide gateway routers for all the IP hosts in the building.

Load balancing across the core is achieved by intelligent Layer 3 routing protocols. For example, with equal-cost paths (Layer 2) between any two buildings, the Layer 3 routing protocols can use equal-cost multipath, multilink PPP, or the Cisco Express Forwarding (CEF) to allow for redundancy and load balancing.

A redundant multi-layer model works well with an enterprise server farm. The server farm is implemented as a modular building block using multi-layer switching. A Gigabit Ethernet trunk carries the server-to-server traffic. A Fast EtherChannel trunk carries backbone traffic. All server-to-server traffic is kept off the backbone, which has both security and performance advantages. The enterprise servers have fast redundancy between the multi-layer switches. Access policy to the server farm can be controlled by access lists.

Scaling Bandwidth

Ethernet trunk capacity in the multi-layer point-to-point model can be scaled in several ways. That is, Ethernet can be migrated to Fast Ethernet; and Fast Ethernet can be migrated to Fast EtherChannel (trunking two or more Fast Ethernet circuits) or to Gigabit Ethernet and then Gigabit EtherChannel (trunking two or more Gigabit Ethernet circuits). Access-layer switches can be partitioned into multiple VLANs with multiple trunks. VLAN multiplexing with ISL or 802.1Q (not both) can be used in combination with the different trunks.
IP Multicast

Applications based on IP multicast represent a small but rapidly growing component of corporate intranets. Applications such as IPTV, Microsoft NetShow and NetMeeting are being tried and deployed. There are several aspects to handling multicasts effectively:

- multicast routing, Protocol Independent Multicast (PIM) dense mode and sparse mode
- clients and servers join to multicast groups with Internet Group Management Protocol (IGMP)
- pruning multicast trees with IGMP snooping
- switch and router multicast performance
- multicast policy

The preferred routing protocol for multicast traffic is the Protocol Independent Multicast (PIM). PIM is being widely deployed in the Internet as well as in corporate intranets. As its name suggests, PIM works with various unicast routing protocols, such as OSPF and Enhanced IGRP.

IGMP is used by multicast clients and servers to join or advertise multicast groups. The local gateway router makes a multicast available on subnets with active listeners, but blocks the traffic if no listeners are present. Switches receive the CGMP message and forward multicast traffic only to ports with the specific MAC address in the forwarding table. This blocks multicast packets from all switch ports that don’t have group members downstream.

One way to implement multicast policy is to place multicast servers in a server farm behind a multi-layer switch. One switch acts as a multicast firewall that enforces rate limiting and controls access to multicast sessions. To further isolate multicast traffic, create a separate multicast VLAN/subnet in the core. The multicast VLAN in the core could be a logical partition of existing core switches or a dedicated switch if traffic is very high. Switch X is a logical place to implement the PIM rendezvous point. The rendezvous point is like the root of the multicast tree.

Scaling Considerations

The multi-layer design model is inherently scalable to support very large organizations and complex networks. Layer 3 switching performance scales because it is distributed. Backbone performance scales as we add more links or more switches. The individual switch domains or buildings scale to over 1000 client devices with two distribution-layer switches in a typical redundant configuration. More building blocks or server blocks can be added to the campus without changing the design model.
Because the multi-layer design model is highly structured and deterministic, it is also scalable from a management and administration perspective.

OSPF overhead in the backbone rises linearly as the number of distribution-layer switches rises because OSPF elects one designated router and one back-up designated router to connect to all the other Layer 3 switches in the distribution layer. If two VLANs are created in the backbone, a designated router and a back-up are elected for each. So the OSPF routing traffic and CPU overhead increase as the number of backbone VLANs increases. For this reason, M-DCPS will keep the number of VLANs in the backbone small.

Another important consideration for OSPF scalability is summarization. For our large district, we will make each building an OSPF area and make the distribution-layer switches area border routers (ABRs). We will pick all the subnets within the building from a contiguous block of addresses and summarize with a single summary advertisement at the ABRs. This reduces the amount of routing information throughout the district and increases the stability of the routing table. Enhanced IGRP can be configured for summarization in the same way.

**Migration Strategies**

The multi-layer design model describes the logical structure of the district. The addressing and Layer 3 design are independent of choice of media. The logical design principles are the same whether implemented with Ethernet, Token Ring, FDDI, or ATM. This is not always true in the case of bridged protocols, such as NetBIOS and Systems Network Architecture (SNA), which are media dependent.

**Security in the Multi-layer Model**

Access control lists are supported by multi-layer switching with no performance degradation. Because all traffic passes through the distribution layer, this is the best place to implement policy with access control lists. These lists can also be used in the control plane of the network to restrict access to the switches themselves. In addition, the TACACS+ and RADIUS protocols provide centralized access control to switches. Software also provides multiple levels of authorization with password encryption. Network managers can be assigned to a particular level at which a specific set of commands are enabled.
10.1.6 Capacity Planning\textsuperscript{52,53}

The role and charter of capacity planning includes three main objectives:

- service level assurance
- financial and technical planning
- support of educational decision-making

Service-level assurance means that factors such as interactive response time and batch turnaround are consistent and acceptable. This means that everyone will know and agree upon what is acceptable for each service. While it may seem that it is not hard to maintain acceptable service with unlimited budget, in fact, there are many financial and technical issues that we need to develop correctly, irrespective of cost. In addition, many factors that need to be fully developed in a well-planned computing and network environment do not have substantial incremental cost.

A close adjunct to service-level assurance is financial and technical planning. This involves meeting acceptable service goals with the greatest efficiency. But both the goals and the financial and technical resources available to meet those goals are changing. Added to this is the timeframe of analysis; maximizing efficiency, when measured over the short term and long term, can yield very different outcomes. To meet these challenges requires a comprehensive technology strategy to provide a map for decision making.

The third aspect of capacity planning is support of educational decision making, both with respect to student learning and educational management. Effective technology planning will take place in the context of the specific needs of the district. Thus, we will support educational decisions as well as technology decisions.

This decision depends on responses to the following questions:

- What can be done within the limitations of the present technology infrastructure?
- What changes to the technology infrastructure are required to support emerging processes?
- What new processes and opportunities can be explored with the expansion or renovation of the technology infrastructure?


Capacity Planning is the determination of the overall size, performance, and resilience of a computing or network system. The detailed components of a capacity plan will vary, depending upon the proposed usage of the system, but M-DCPS will always consider the following:

- the required performance and response required from both the system and the network—i.e., the end-to-end performance
- the level of resilience required and the planned cycle of usage—peaks, troughs, and average
- the need for 24/7 operations and the acceptability of downing the system for maintenance and other remedial work
- the anticipated storage capacity of the system and the amount of data retrieved, created, and stored within a given cycle
- the number of online processes and the estimated likely contention.
- the impact of security measures and back-up of data

In the past network architects could simply add more bandwidth to networks or servers to the farm to improve performance while the organization added more users and services. As networks become more complex and users come to rely on technology more completely the art of capacity planning isn't as simple as more is more.

In education, the drive to use resources efficiently is intense. The days of over-provisioning to be assured of capacity have ended. Planning tools can also be used to uncover underused resources and avoid purchasing more hardware.

However, we need to be aware that software tools do not represent a cure-all for capacity-planning woes. Capacity planning requires knowledge of the way all the computing and network elements interact and perform. That only comes from years of study and experience with networks. If we ask the wrong question, we will get a nifty answer, but it may not solve our problem. Obviously, we need to know the right questions to ask. Capacity planning has the characteristics of an art form, one that requires an artist skilled in advanced mathematics and statistical analysis, with an eye for spotting behavior patterns in volumes of data. In addition, tools builders point out that users often do not focus on long-term planning, opting more for quick fixes that sometimes don't solve the problems and prompt network managers to overprovision networks and servers.

An effective capacity planning methodology involves two flows of activity:

- development of a functional model of the systems under consideration
- development of a cost model of systems operation
The functional model is grounded in the technology at a very fundamental level. In many cases, the quality of capacity planning is dependent upon the underlying the functional model. Once the technology is laid out and interconnected, functional aspects, such as the form of the demand and the profile of demand over time, are included to characterize the work that is accomplished by the system. Because demand and functional capabilities of systems are interconnected, a closed loop is required to reflect changes in demand characteristics that are driven by changes in technology. Other aspects of the functional model include validation and calibration of the functional metrics, a means to forecast demand, and a way to predict performance that brings together models and forecasts.

The cost model captures implementation, incremental, and operational expense associated with each technology component or function. The cost model is interconnected to the functional model to reflect changes in value arising from changes in actual and predicted functional elements. Interaction of the functional and cost models yields a configuration plan, an investment plan, and a staffing plan.

The relationship between requirements and capacity is based on developing computing and network systems resources to enable satisfied users. With the requirements known, it is possible to meet user expectations in three ways:

- by designing a system to meet or exceed the predicted requirements
- by altering the requirements by managing the workload
- by tuning processes to remove demand

A significant part of planning capacity is continually gathering and predicting future requirements and then making the necessary adjustments to ensure that the workload is smaller than the available capacity in both steady and peak states. Making the adjustments is the juncture at which capacity planning experience, educational process knowledge, and creativity come together.
10.1.7 Strategic Management of Technology

For many districts, educational management and information management are locked in a death spiral of interrelated inefficiencies. Overcoming these difficulties requires radical technological and process changes. Compounding this problem, trust is almost completely lacking between IT and their customers. Each views the world from very different perspectives, and together they agree on very little, especially the deployment of new enabling technologies.

Prospects for Change

Recognizing the interdependence of educational management and information management and using that understanding to make changes are two different things. Although collaboration and teaming are required to synchronize technology and process changes, a gulf exists in most organizations today. A gulf of perceptions and understanding separates those in the IT process from those involved in the management of the educational processes (IT customers). As a result, trust is generally lacking, and both sides feel frustrated, disappointed, and dissatisfied with the other party’s performance.

The two camps (IT customers and their suppliers) speak different languages and hold dramatically different attitudes about the potential role of technology. Combined, these differences seem to create an inherent barrier to significant change. Learning organizations that cannot successfully employ and synchronize radical technological and process changes are increasingly falling behind in their ability to meet the changing expectations of their customers.

The process automation arena is one of the more significant battlefields. Most process automation technologies are not well suited to traditional justifications as they are not targeted at reducing the costs of specific production processes. In addition, many of them are enabling technologies, which derive most of their benefits from dramatic changes to processes, not from simple automation or reductions in cost. E-mail,
for example, is an enabling technology, and its true value comes from the changes that result to the district as a whole, not just from the displacement of paper mail.

Paradoxically, it is enabling technologies that could do the most to improve district performance and help reduce the impasse between management and information management personnel. But successful deployment of enabling technologies requires the teaming of IT staff and their customers. Such a level of collaboration is difficult in many organizations in which the gulf of understanding results in open warfare over control of how decision-making responsibilities are allocated; how budget levels are set; what mechanisms are used to allocate funds; how projects are approved and managed; how technologies and technology standards are selected and implemented.

Correcting these problems requires that both the IT staff and their customers stop blaming each other for not doing things correctly, and develop a shared vocabulary and value system toward integrating the necessary changes. Before a solution can be found, however, the cause of this interdependent ineffectiveness must be identified. Some causes and approaches to resolving them are addressed below.

**Finance-based Concepts of Value**

Management, not capital, is the critical input to modern organizations. Because of this, a continued reliance on finance-based indices of value prevents organizations from making intelligent choices when dealing with overhead (the costs of management) and IT (the tools of management).

The conceptual turning point occurred when an epidemiological model was proposed, in which technology is analogous to prescription drugs. The application, doses, and therapeutic powers can be clinically substantiated before use.

American productivity appeared to fall as white-collar workers became an increasing portion of the labor force and the gains from "information work" evaded calculation. Reduction of clerical and secretarial staff is counted as a cost savings, even if their work is just shifted to higher paid managerial and professional personnel.

**Misperceptions of Scarcity**

The classic methods of measuring financial value, such as return on assets (ROA) and return on investment, (ROI) trace their origin to a time when capital was the scarcest and thus most valuable, input. Today, people who can organize and motivate their employees and know how to maximize the use of capital may be more scarce than capital itself.
Confusion over Overhead

As budgets are reduced, many organizations respond by cutting overhead, which is the costs associated with management. This makes sense if money—not management—is the critical scarce resource. But current funding prevents organizations from understanding the fundamental economics of overhead and the true impact of these decisions. Overhead has value—specifically, preparing for the future.

In districts today, the biggest challenge is not how to "cut overhead" but how to re-engineer management processes and infuse them with needed information technologies to make them more efficient and responsive.

Today's information systems offer the district unprecedented opportunities to provide higher quality services tailored to the public's changing needs, delivered faster, more effectively and cheaply. Moreover, they can enhance the quality and accessibility of important knowledge and information, both for the public and for federal managers.

It is the need to improve the effectiveness of management that drives the various definitions of strategic value, but the same misperceptions of relative value that produce erroneous decisions about overhead often prevent needed information technologies from being developed and deployed.

Impact on IT

A fixation on dollars as the ultimate measure of value drove the processes that were used to select and manage all significant organizational change.

When applied to IT investments, these processes become counterproductive, preventing needed changes. By focusing on the budget sheet, it is easy to miss the big picture. In fact, if an organization believes that measuring cost savings does provide a complete picture; the company is probably limiting itself to the automation of routine and clerical operations, and has abandoned efforts to provide strategic value. Even more fundamentally, this approach actually backfires, and what appears to be cost control results in chaos and uncontrolled cost.

Despite the problems, however, money is one of the few concepts that all parties seem to understand. Project justifications regularly rely on calculated cost savings, which can be tangible, intangible, realizable, or even imagined. As there are few or no accepted methods of calculating cost impacts, some very creative calculations are applied. Development, implementation and maintenance costs are underestimated. Training and support costs are shifted to end-user organizations. Downstream uses of
information are ignored, discounting the organizational cost of sub-optimized "stovepipe" solutions.

If cost does not provide an adequate conceptual framework for integrating changes to district practices and IT, what can take its place? The following section attempts to outline some of the key drivers, concepts, and approaches that can be used to accomplish this integration, both in individual projects and in the development of institutional infrastructures for change.

**Performance-based Concepts of Value**

While the references noted earlier differ slightly, they all agree on one thing: The only useful measure of IT value is the performance of the organization. Technology alone cannot make a district more effective and that is precisely the point. If IT is not fully integrated with other district changes, it is not likely to meet its objectives.

Strategic value shifts the focus from information technologies to information management (IM) and ties IM to the district’s goals and objectives. Strategic value provides IM providers and consumers with a common vocabulary for reaching consensus and a conceptual framework for expanding cost-benefit calculations to include a broad range of performance measures such as cost, time, quality, and risk.

The challenge is to "promote a new focus on results." Results become the big measurement, not just dollars. The shift in focus from costs and savings to results raises the stakes for all parties. ITS’ customers must be able to articulate their missions and goals; suppliers must be able to find better arguments than everybody's doing it; and, together, both groups must collaborate to match technology to district needs.

**Strategic Information Management**

The GAO Executive Guide identifies three functions that are "critical to building a modern information management infrastructure" and eleven fundamental practices that are grouped by the functions. The eleven practices do not appear to be in any particular order.

**I. Decide to Change**

- recognize and communicate the urgency to change information management practices
- get principals and department heads involved and create ownership
- take action and maintain momentum
II. Direct Change

- anchor strategic planning in customer needs and mission goals
- measure the performance of key mission delivery processes
- focus on process improvement in the context of an architecture
- manage information systems projects as investments
- integrate the planning, budgeting and evaluation process

III. Support Change

- establish customer/supplier relationships between line and information management professionals
- position a Chief Information Officer as a senior management partner
- upgrade skills and knowledge of line and information management professionals

IT professionals need to broaden their views beyond their current technology focus. One approach may be to apply the concepts of technology transfer. Outsourcing should be used, not just for reducing or eliminating the work scope of the existing organizations, but as a tool for increasing the skill levels of agency and contractor employees. The bundling of on-site training with software, hardware, and integration services contracts can be an important mechanism for injecting needed skills.

At its core Information Management is based on the simple idea of the customer defining the criteria against which performance will be measured and thus paid for. Put in different terms, the IT customers working with IT will negotiate service level agreements for the critical services provided. Further, these service level agreements must be aligned with district and departmental goals and objectives.

For many districts, information management has been reduced to a cost-savings program. This is no longer sufficient to meet rising customer expectations. Management practices that made sense at the turn of the century no longer fit an economy dominated by the production of goods and services that are increasingly differentiated by their growing information content.

Again, the shift from finance-based to performance-based concepts of value is critical to developing a common framework for measuring the impact of IT on organizational effectiveness.
Use of Standards to Manage Support Costs

The use of standards is critical for managing the total cost of ownership. Standards play an important role by establishing organizational clarity on technology, educational and administrative processes, and procedures. Technology standards include not only the technology itself, but also how that technology is configured, managed and supported. Standards must also be applied to the educational and administrative processes and procedures utilized in managing an organization's networking environment, particularly if that organization utilizes remote sites. Standards and guidelines are crucial to establish a productive IT environment at a reasonable cost.

Standards must be applied where they make the most sense; an organization does not have to have 100% conformance to a standard. The ultimate goal is organizational effectiveness and not universal conformity to a standard. Standards enable an organization to take better advantage of volume pricing, decrease acquisition processing costs, decrease support and training costs, and improve the organization's ability to share data and applications. Standardization needs to be considered on five fronts: hardware, user interface, applications, infrastructure, and processes.

Better Coordination among Support Structures

Many computing environments are developed with multi-layered support structures but lack an overall coordination of effort. For example, those that support telecommunication equipment installation typically do not consult with those installing the desktop computer for a user. A lack of coordination results in severe levels of duplicated services and limits an organization's ability to implement standards and apply system management tools. An organization's Information Systems Department needs to define the boundaries and roles of computing, communications, and user support groups. The important goal is the clear delineation of responsibilities for supporting the desktop-computing environment. Organizations need to realize that the computing asset base needs to be administered and managed and not ignored. Organizations that have implemented centralized management and operation of servers are experiencing measurably lower operations costs.

Automated Inventory and Software Metering Tools

A current inventory of computing, communication, and network hardware and software assets can assist in eliminating duplicative maintenance, improve asset disposal, eliminate duplicate software licensing fees, and improve disaster recovery planning to reduce support costs. Manual
tracking of the inventory is a difficult job requiring physical inspection of each item. Automated inventory systems significantly accelerate the effort and are less costly than traditional manual inspections.

Software-metering tools allow an organization to identify easily the software used by the network and assist in determining the correct number of software licenses. Metering tools can also assist support staff in determining concurrent use of software applications when the software is distributed to all users, and licenses are determined according to the number of executions. Metering systems play an important role in security and software distribution by enforcing limited-use and site licenses for particular software packages. An effective inventory control system should track both hardware and software assets.

Remote Access Maintenance, Virus Detection, and Back-up

When systems are distributed, it is extremely difficult to perform routine maintenance and inspection of the system, conduct enterprise-wide virus detection and repair and perform data back-up and restoration. In a networked environment, the vast majority of maintenance functions can be performed through automated remote-access tools that allow ITS staff to open a session on other systems in the network, run programs and diagnostics, and inspect and alter files. The M-DCPS BigFix initiative will prove to be a valuable tool to assist in this effort.

Network virus detection programs allow ITS support staff to execute virus scans either on demand or on a scheduled basis and initiate automatic repair or system isolation.

The back-up process wastes both time and equipment when it is performed by the end user and may also lead to lost, misplaced, and stolen back-up media. An organization should conduct both scheduled full and incremental back-ups for data. In addition, an organization should design their LAN systems to include appropriate bandwidth and storage capacity for more efficient on-line storage utilization. It is critical to reduce the support costs associated with routine maintenance, and virus detection and repair. Centralized Network Attached Storage which the distributed systems can push backups of valuable information will offer M-DCPS the opportunity to take advantage of unused network bandwidth (overnight) and centralize information storage and improve risks associated with a disaster and potential data loss at any of the remote buildings.

10.1.8 Equity of Connectivity

This section addresses specific issues of equity as they affect and are affected by technology. One of the primary elements of equity arising in contemporary instructional models is access to digital communication and
information resources. These resources are delivered via the network, making connection to the workstation level a significant requirement to assure equity in this area. Chapter III of the *Information Technology Blueprint* includes a comprehensive perspective on equity.

**Access** refers to a student's ability to use instructional technologies to support and enhance learning. Access is linked to several important variables:

- number of computers and the student-to-computer ratio
- location, configuration and scheduling of technology resources
- mobility and flexibility of instructional technologies
- the use of wired or wireless networking to transcend classroom and school facility boundaries
- proficiency of teachers and administrators to support and guide instruction

**Acquisition** deals with the funding approaches and decision-making processes by which schools acquire instructional technology resources. Use of coherent acquisition processes will help to ensure that:

- schools are provided with equipment that meets or exceeds district specifications
- equipment and systems comply with district standards to assure effective connectivity and management
- all students have access to current, appropriate and sufficient information resources
- existing resources are used up to their potential so that future dollars can be spent in areas of greatest need
- all schools attain a sufficient infusion of instructional technologies to attain district goals through local implementation solutions

The development of critical-mass guidelines and configurations for classrooms and learning environments provides the means to reach access and equity objectives. It is important to recognize that in highly effective learning environments, one-to-one student-to-computer access is often a requirement. Critical-mass ratios do not imply a distribution strategy or any specific configuration. A blend of desktop computers, portable computers, hand-held devices (PDAs), calculators, and other alternative computing devices may add the mobility and flexibility to bring 1:1 access into classrooms.

Workstations are not the only critical-mass components. Other critical systems and services include:

- network infrastructure throughout facilities
• sufficient bandwidth to central resources and the Internet
• capable technical and functional support
• staff development and facilitator training

Technology implementation requires adequate support and training for effective use to maximize its ability to promote equity.

Policies deal with the funding approaches and decision-making processes by which schools acquire instructional technology resources and the fair and equitable distribution of those resources.

Acquisition and management of technology resources to support equity will help to ensure that:
• each classroom has the same measure of technology resources no matter whether it is permanent or temporary
• schools are provided with equipment that meets or exceeds standards
• all students have access to current, appropriate and sufficient information resources
• existing resources are used to their maximum potential so that future dollars are spent in areas of greatest need
• all schools attain a sufficient infusion of instructional technologies to attain district goals through local implementation solutions

It is necessary to define and embrace critical mass configurations for classrooms and learning environments at all levels. Critical mass is defined as that level of technology infusion sufficient for measurable gains in student performance.

10.2 Emerging Issues

Emerging issues include topics presently under consideration in M-DCPS or those that are becoming relevant to similar districts across the country. It is necessary to include each of these in planning for the future of infrastructure resources.

The following topics provide a strategic framework for development of an effective computing, communication, and network infrastructure.
10.2.1 Wireless Networking and Hybrid Networking

Wireless technology provides options that were not practical until very recently. The primary benefit of wireless technology is elimination of the cable, but the primary deficiency of wireless technology is also elimination of the cable. Wireless technology promotes mobility and swift deployment. However, if power is required to serve the device, much of the advantage for wireless connectivity is rendered moot by the need for connection of power.

With the advent of switching at levels 2 and 3 in the network, the collision domain has been reduced to one device. In wireless networking, devices within proximity of a wireless bridge are in a collision domain as for old 802 networks. For this reason, deployment of wireless technology needs to be carefully considered in a context that goes beyond the network itself.

The primary aspect of equity as a factor in the data infrastructure is related to deployment to every classroom, including and, in particular, portable classrooms. Wireless technology provides an attractive alternative to wired technology in this case due to the speed of deployment possible and the reduced cost achieved by eliminating the need for in-ground installation of cable. In addition, wireless technology helps to eliminate certain distance limitations built into the protocols for the cabling infrastructure.

**Wireless networks do not replace wired networks. They are a complement to them to provide connectivity for mobile users.**

Issues for deployment of wireless networks include:

- alignment of compelling benefit with network functionality
- rapid achievement of equity
- data security and access control
- plan to integrate wired and wireless network into a single hybrid network
10.2.2 Web-based Resources

Web-based resources include content served to the desktop via the browser. This now covers a broad range of content from simple text to integrated productivity documents. In most cases, the objective of Web-based content has been to provide platform-independent access and a similar experience for users with diverse machines and browsers. As such, the form of the content must address the issue of user resources: e.g., if a Word-formatted document is being delivered, each user must have Word installed and connected to his/her browser. Advanced use of HTML and related protocols are able to relieve nearly all need for proprietary-format documents.

Issues for deployment of Web-based resources include:

- vision for utilization of Web-based resources
- proprietary applications and content that do not cross platforms
- assessment of network demand and increased reliability required by digital media
- Web-based access in central application migration strategies

10.2.3 Collaboration

Real-time, digitally mediated conversations are taking on new characteristics as the capabilities of local- and wide-area networks increase.

Conferencing is gaining attention and its use within M-DCPS is limited if at all. Collaboration extends conferencing to include white-boards and shared desktops, applications, and information to provide a common environment for interaction and productivity for users dispersed geographically. Truly advanced applications that use virtual reality simulators are being used in industry to design aircraft and conduct research. While this will probably not be a realistic application for education for many years, it is not impossible to envision the way a classroom could easily be virtualized. This application is actually being used as a just-in-time training methodology for rapid response teams in the military.

Three aspects that make collaboration different than telephonic communication include the support of visual communication, alignment of signal streams in time (both parts of conferencing), and creation of an immersive environment for interaction. Conventional audio technology has migrated from analog signals to digital signals with relative ease throughout the telephone system. The move to visual content has lagged significantly compared to the predictions and expectations made even as
recently as ten years ago. The picture phone is not the appliance that it was expected to be. The reasons for this are twofold: bandwidth demand for visual information and the time aligned nature of visual content and synchronization with associated audio content. Creation of an immersive environment is similarly difficult. The diversity of exchanged information is increased, and the mediation of the environment requires an advanced application layer to coordinate interaction.

Issues for deployment of collaboration systems include:

- integration of digitally mediated communication into the culture
- acceptance of certain limitations and adoption of compensatory methods
- identification of practical uses for collaboration
- development of network strategies to support collaboration
- selection of workstations to readily support collaboration
- development of pilot and test-bed sites with practical work to be done
- development of cost models that consider lost productivity for travel

10.2.4 24 / 7 Access

As access to information and communication resources becomes even more fundamental to effective administrative and educational processes, and as users become connected via the Web, M-DCPS will adopt an always-on approach to the communication and information infrastructure. As the Web and other connectivity options provide access for administrative and educational processes, users will no longer be limited by geography or the clock in their need for access. An extreme example is the virtual high school that could literally serve a global community.

Issues of 24 / 7 access include:

- support and maintenance services available 24 / 7
- greater systems reliability to reduce off-hours service disruptions
- independence of systems services from employee work cycles
- remote management of systems to facilitate rapid response
10.3 Data Infrastructure CNI-3:  CNI-4:

The research and best practice information in the following section supports recommendation CNI-3: Update Construction and Cabling Specifications for Data Infrastructure and CNI-4: Implement IVR with Exploration for Integration.

Data infrastructure provides connectivity for digital communication across the district down to the classroom and workstation level. The definition of data will be expanded to account for more than classic definitions of information to include digitized communication, media, and other signal and control information. The common factor in all of this is TCP/IP or Internet protocol for address and packet organization. What this means is that anything that is digitized and organized into packets with addresses that comply with TCP/IP will be transported transparently across the network.

10.3.1 Wide Area Network

M-DCPS is undergoing a wide area network conversion to Bell South’s NMLI service. Presently M-DCPS uses T1/T3 circuits and frame relay for transport of data and Internet information. The objectives for the WAN are to:

- provide access to Web-based content for instruction, research and learning enrichment from the Internet and from school and central Web servers
- connect individuals, departments and constituencies across the district and in the future will support textual and verbal communication with visual and collaborative adjuncts
- provide the means to process forms, workflow and surveys for administrative purpose
- deliver media to workstation for student learning and staff training
- provide secure access to protected student, financial and human resource information
- provide central management, back up and security to workstations and file and application servers

Beyond any other function, the WAN provides the means to interconnect the district into a cohesive whole for learning, teaching, and administration. To achieve this vision, school and district staff must strive to build a culture in which technology is a primary communication mode. An outcome will be the need for greater bandwidth to serve digitization of disparate services.
A stable and predictable network is essential if people are to rely on it for instructional and administrative uses. M-DCPS has a network operations center to monitor, troubleshoot, and quickly repair the network all the way down to the school level.

The legacy WAN is provisioned and managed by BellSouth including one T1 (1.54 Mbps wire speed) to each school from a central router operating on the frame relay protocol. WAN connections are being upgraded to NMLI, with about 50 schools already connected.

E-rate funds are presently used to pay for a percentage of the M-DCPS WAN. It is anticipated that the program will continue for the next several years, but at some point the program will be terminated and subsidies may be ended as well.

Issues for deployment of the wide area network include:
- universal protocols to serve diverse data streams
- throughput to meet foreseeable needs
- scalability to meet future needs
- data protection to secure communications
- robustness of systems to sustain failure and hazard
- traffic assessment and shaping

10.3.2 Local Area Networks

At this time all local area networks are administered by ITS. LANs have been implemented in all schools and district facilities service primary workstation locations in offices and classrooms.

The network has been developed along conventional guidelines to serve data processing and limited communications. In the future, the role of the LAN will expand to include:
- building control
- security and surveillance
- voice communication
- television and digital media distribution
- conferencing and dispersed classrooms

Meeting these functions will require expansion of the physical infrastructure to new locations in addition to cable runs to traditional workstation locations.

Issues for deployment of local area networks include:
- anything IP transport capability
• incremental expandability to propagate throughout the facility
• remote monitoring and configuration of network devices
• fully integrated wired and wireless model

10.3.3 Broadband Wireless Network

M-DCPS currently owns Federal Communications Commission (FCC) licensed wireless frequencies, which have traditionally been used for instructional television broadcast by WLRN's ITV organization. Today the technology exists to use these wireless frequencies to build a broadband wireless network. BECON is rolling out a wireless network throughout the county, connecting all of the schools to provide additional Intranet capacity for specific applications. If the wireless build-out is approved, then M-DCPS may have the capability to provide wireless connectivity to low-income homes within a range of a school.

Wireless wide area networking should be positioned in the context of a comprehensive plan that defines the total cost of ownership as well as the strengths and weaknesses in a strategic framework.

Issues for deployment of broadband wireless networks include:

• robustness and survivability
• plan for integration of wireless technology into a single wan strategy
• integration of equipment and towers into facilities
• access control and data security
• standards and universal protocols for transport transparency
• issues of security and access arise with public access to the WAN

10.3.4 Network Operations Management

As the digitization of communication and information continues, the district will come to rely more completely on the wide- and local-area networks and network-connected equipment. One of the primary ways to provide the robustness required to meet this demand is through effective network operations management. The role of network operations management is fourfold:

• remote monitoring, configuration and maintenance of network equipment and network connected devices
• swift discovery of faults and destructive events
• swift response to failures and disruptions
• assessment of trends and tune-up of system for optimum functions

Provision of an operations center and remote management services maximizes operational performance while minimizing operational cost. In addition to monitoring the health of the network, it is possible to monitor nearly any type of network-connected device including printers, copiers, telephone equipment, building management equipment, and surveillance equipment.

Critical to network management are performance metrics that can be used to assess functionality in the area between functional and failed. Individual perception of performance is highly subjective and the root cause for actual performance deterioration is not always evident. Both of these are more easily determined with a suite of performance monitors and objectives to be met. In addition, it is possible to implement a total cost of ownership appraisal that is tied to performance of network systems.

M-DCPS has a network operations center in place to monitor network equipment functionality and external service delivery for Internet and wide area circuits.

Issues for network operations management include:
• any network-connected device
• network as service-delivery system or network as utility model
• total cost of ownership-defined

10.3.5 Network Authentication and Single Sign-on

Network authentication and single sign-on are means to increase network and data security simultaneously while simplifying access for users. Traditionally, when someone logs in to an application, the application manages security and access to data. Instead of users entering codes and passwords directly to each application, the application will query a central authentication database to determine if access should be granted.

There are many applications for network authentication and single sign-on. Management of student and staff accounts will be easier if it is done centrally for all applications. For example, a student could use the same user and password whether they were working on Macintosh or Windows computers, allowing a single consolidated location for their work no matter which computer they were using.
To make single sign-on work, M-DCPS, a central directory of all users and an authentication server that will transparently work for all users irrespective of the applications they use or the platform they use. Today such central authentication services use the industry standard LDAP (Light-weight Directory Access Protocol). M-DCPS is using Microsoft’s version of LDAP, known as Active Directory. Not all applications and data servers can currently use this authentication service. However, there are techniques than can be used to include many of these older applications into the single sign-on environment.

Issues for deployment of network authentication and single sign-on include:

- universal service across all applications, servers, and workstations, including Macintosh and Windows
- comprehensive policies for access and security
- user training and assurance of compliance with policies
- protection of authentication servers

### 10.4 Communications Infrastructure

There is an artificial line between communication infrastructure and data infrastructure. This line acts to separate data systems that provide transport for digitized information from the applications, and services that use the infrastructure for transport. Some of these applications and services have a proprietary transport technology that may or may not be converged onto a digital transport in the future.

#### 10.4.1 Internet Access

The research and best practice information in the following section supports recommendation CNI-5: Acquire Additional Capacity and Redundancy for Internet Access.

M-DCPS provides access to the Internet for both educational and administrative purposes. The district provides controls to prevent students, staff, and community users from accessing inappropriate content through a centralized filtering server. This ensures that the district is compliant with the Child Internet Protection Act. ITS also maintains a firewall to protect servers, applications, and databases from intrusion through the Internet.

M-DCPS has identified the potential problem of Internet demand surpassing current capacity and has started to plan to add capacity. Based on information collected with the 23 sites that have been cut-over
to NMLI, an increase of approximately 40 percent has been observed in the data going over the links to those schools. This increased bandwidth utilization over the WAN is most likely a blend of district central services and Internet traffic. This total peak demand will most likely fall between 217 Mbps and 365 Mbps as all schools are connected over the next year and a half.

The connection to FIRN is over a single OC-3 Packet-over-SONET fiber connection using frame relay encapsulation and a single static route. Best practices call for connection to the Internet over two physically separate routes, ideally to different service providers.

10.4.2 Conferencing and Distance Learning

Today, opportunities for conferencing and distance learning are dramatically expanding as technologies advance and costs decrease. Two-way video now allows the instructor and participants to see as well as hear each other at remote sites. Conferencing may be used for dispersed administrative meetings, teacher collaborations, student instruction, and professional development.

Issues for deployment of conferencing and distance learning include:

- comfort with technology-mediated conferencing for communication
- reliability and quality of presentation systems and transport
- effectively dispersed classroom management systems
- common protocols for interconnection
- transport priority for conferencing signals
- curriculum and media to support distance learning

10.4.3 Fixed Voice Communication

The research and best practice information in the following section supports recommendation CNI-6: Implement Voice over IP and Video Conferencing in Network.

The district currently uses a separate infrastructure from BellSouth for its voice services. Voice communications is provided through a network to school and administration sites through Centrex PRI T1 and Centrex analog circuits. The PRI circuits are used for voice, conferencing and distance learning. Recently the district installed new PBX systems in all the schools. Classrooms in general do not have phones, although they are wired for phones.
Issues for deployment of voice communication infrastructure include:

- total cost of ownership analysis and service level agreements
- migration strategy to converged networking and IP telephony
- shared use of the WAN for optimum transport efficiency

10.4.4 Portable Voice Communication

Cellular technology makes telephonic communication completely portable. There is seldom a direct connection between the wired telephone number assigned to a person and a person's cellular telephone number. A caller does not know which number and instrument to use at the appropriate time resulting in missed contact that could have been made or double calls to assure contact.

Cellular systems rely on an infrastructure that combines radio technology ‘above the ground’ and wired networks below the ground. This provides the means for communication to extend anywhere in the district and beyond with great facility. These technologies are somewhat vulnerable to disasters, such as wind damage and earthquakes.

Systems are emerging that interconnect fixed and portable communication technology, provide video and image transport across the network, and have mini-browsers for interaction with Web-based forms.

Issues for portable voice communication include:

- alignment of cellular functionality with user needs
- integration between cellular systems and fixed systems
- policy for private use of cellular telephones
- position of cellular telephones in communication strategy
- optimized service plan for large organizational user

10.4.5 Two-way Radio

Two-way radios are tools for instant person-to-person communication. Because they can operate without a supporting infrastructure, radios are particularly good for communication during first response to disaster and crisis situations. In addition, there is no call set-up; so communication can be immediate, making radios most suitable for brief conversations within a close range.

Some advanced cellular features duplicate much of the radio functionality, but these systems may remain vulnerable to certain disasters situations.
Issues for two-way radios include:
- alignment of radio functionality with user needs
- position of radios in a larger communication strategy

10.4.6 Paging

Paging systems provided one-way communication to alert an individual of the need to make contact with a message center. Much of this functionality has been superseded by cellular systems, but there is a distinct difference in cost between the two technologies. For many applications, the low cost of paging outweighs the relatively long time to get a response.

Second-generation paging systems provide message delivery and signaled response, and are viable communication options in situations where conversations are not required for notification or information exchange.

Issues for paging include:
- alignment of paging functionality with user needs
- position of paging in a larger communication strategy

10.4.7 Cable Television

Schools have a closed circuit cable TV distribution network that goes to the classrooms, where programs broadcast from WLRN's ITV can be viewed or recorded.

Issues for deployment of cable television infrastructure include:
- integration of cable television into a converged network at the school
- integration of CATV into communication strategy for the WAN

10.4.8 Community-wide Connectivity

Community-wide connectivity has four aspects in the context of this discussion:
- To make information and resources available via the Web
- To support initiatives to advance connectivity of the community
- To open facilities to provide access
- To provide a channel for access via district infrastructure
The motivation for community-wide connectivity is to enhance communication among school staff, parents, and students, and to deliver information to the community.

M-DCPS interactive voice response (IVR) system will provide parents with multi-lingual access to student gradebook and a variety of other information via a telephone system.

Because of its pervasive influence on the community, the district is in a unique position to support initiatives that help provide access for underserved and disadvantaged members of the community. Some of these may include support of check-offs that contribute to funds for delivery of services to disadvantaged members of the community, building awareness of the advantages of connectivity, and training for the community to increase skills and comfort of access.

Because the school system reaches deeply into all geographies of the community, there is reason to investigate ways that district network resources can be extended to the community. In particular, the use of wireless broadband technology could easily make the network available to the community; and with anticipated peaks of demand from the community not coincident with district demand, there could be synergy of purpose.

Several critical issues need to be resolved:

- Connectivity is considered a critical resource by most users and is expected to be highly reliable and continuously available.
- There could be conflicts over access to content that is considered unsuitable for distribution over the school networks.
- Access at the fringe of the network introduces significant security risks to school and central data resources.
- Liability for user protection from identity theft, system intrusion, and viruses.
- Issues for deployment of community-wide connectivity include:
  - exploration of alliances with other public institutions to consolidate need and funding.
  - seek support for programs to subsidize disadvantaged community connectivity.
  - community connectivity is not as high a priority as district connectivity.
10.4.9 E-mail and Unified Messaging

Best practices in the use of e-mail in districts include:

- A single email system used by staff and students.
- Use of central authentication server that is automatically updated by the HR and student systems for valid users.
- Accessible from home and from district sites.
- Supports web access as well as client program access.
- Includes automatic protection from inappropriate messages.

The district is in the middle of transferring a multitude of e-mail systems run in schools and departments into a single e-mail system that will support all staff and potentially all students.

Issues for deployment of e-mail and unified messaging include:

- incentives and reward to encourage adoption of unified messaging.
- institutionalization and cultural integration of unified messaging.
- Web access to all messaging resources.
- deeper integration of messaging and communication functionality.

10.4.10 Surveillance, Security, and Access Control

The need to be aware of potential problems and the need to mount a rapid response have increased the need for effective surveillance and security systems.

Characteristics of surveillance systems include:

- provision for audio and video observation of critical locations
- direct monitoring of locations by staff

Characteristics of security systems include:

- sensor-based observations of critical locations
- automated monitoring with notification of potential events based on presence of anomalous conditions.

Characteristics of access control systems include:

- automated locking and unlocking of doors based on a schedule
- identification of authorized access using some card or token that the person possesses
- tracking and reporting on access
The functions of surveillance, security, and access control can be integrated into single systems that combine and coordinate functionality to enhance protection while reducing direct monitoring or intervention. Until recently, these systems required a dedicated wiring infrastructure. Present systems use intelligent devices with IP addressing that can be plugged into Ethernet TCP/IP networks.

Issues for deployment of surveillance and security include:

- standards for deployment of systems
- interconnection and integration of technologies
- non-intrusive and non-threatening functionality
- ease of use to help assure use and limit abuse
- staff awareness that systems only enhance protection
- effective monitoring and response infrastructure

10.4.11 Transportation Safety

Transportation safety accounts for several critical aspects of student safety:

- tracking of who is on the bus and the point of entrance
- tracking of when and where students leave the bus
- tracking and automatic reporting of bus location
- automatic reporting of functional problems with the bus
- communication with the driver
- surveillance of the bus to observe student behavior.

These systems combine access control, surveillance, and communication on a moving platform. GPS receivers track location, and vehicle sensors monitor everything from fuel level to speed. Evaluation of any system must account for functional capabilities under dire and severe disaster and crisis situations.

Issues for deployment of transportation safety include:

- alignment of access control with facility access control
- robustness of technology under disaster and crisis situations
- ease of use to assure effective student tracking
- effective monitoring and response infrastructure
10.5 Video Infrastructure

The research and best practice information in the following section supports recommendation CNI-7: Plan and Implement Integrated Network Plan and Digital Broadband Wireless Network.

Today it is common for each school to have a broadband closed circuit cable TV (CATV) video distribution network delivered to each classroom and other locations in the school facility. This solution should offer a combination of captured “over the air” or cable TV stations and the ability for the school to access the CATV network to broadcast in school generated video.

The future movement toward digital broadcast and convergence will require significant planning and implementation at the local level, and schools need to begin planning for this today. The FCC has mandated all Instructional Fixed Television Service (ITFS) networks be converted to digital and schools are demanding video streaming and video conferencing.

Video and video conferencing can be distributed over the wide area IP network (WAN) using TCP/IP and web streaming technologies. The wide area network and local area networks are already digital. Any authorized desktop can view digital video content as needed. Unlike the closed circuit cable TV system, there is no need for a digital set top box to be able to view digital video. To enable efficient broadcast services, each schools network should be configured to support Internet Protocol (IP) multicast. IP multicast is a bandwidth-conserving technology that simultaneously delivers a single stream of information to any member of the multicast network.

With the implementation of widely available video streaming server solutions, users can search and select appropriate content via a web browser and then have that video delivered to the desktops on-demand. The user can also control all aspects of the video delivery, i.e. pause, fast forward, rewind, etc. This technology keeps the content in a central distribution point in the network. For video on demand, each user will establish independent unicast sessions with the video server platform. Video broadcasts can be accomplished with Multicast IP.

Future delivery of video to the classroom will be replaced with digital streaming to the desktop. TV’s mounted in the classroom will be replaced with LCD projectors connected to a computer display, eliminating the need for the TV and the entire broadband coax infrastructure.

When enabled, the Multicast streams for video broadcasts will use between 300kbps and 2Mbps depending on the overall quality of the broadcast. On-demand users will be expected to fall within this range as well. Any use of on-demand video streaming should be carefully planned, as the quality of service needs to be built into the network to guarantee user satisfaction. In addition to
this, the on-demand web streaming requests will be unpredictable and available bandwidth and server capacity can rapidly be consumed and may impact other services unless planned for.

New school construction should consider the costs of broadband coax infrastructure and consider installing modern video servers providing video resources over the data network. LCD projectors should be considered instead of TV monitors. Locations that require analog Cable TV can be serviced over the network using devices to transmit video/audio over twisted pair Category 5E/6 networks. The category 5E/6 TCP/IP network can also be used to implement security cameras and other video monitoring and security and surveillance requirements.

When enabled, each Multicast stream for broadcast will use between 300 kbps and 2Mbps depending on the overall quality of the broadcast. On-demand users will be expected to fall within this range as well. Any use of on-demand video streaming should be carefully planned, as the quality of service needs to be built into the network to guarantee user satisfaction. In addition to this, the on-demand web streaming requests will be unpredictable and available bandwidth and server capacity can rapidly be consumed and may impact other services unless planned for in advance.

10.6 Computing Infrastructure

The research and best practice information in the following section supports recommendation CNI-9: Develop Central Network Attached Storage and Offer Service to Schools.

The computing infrastructure is defined primarily as those systems supporting enterprise-wide information applications, that is, applications accessed by users across the entire district. These resources are located at the central data center and in data centers at each school and in some departments.

This section addresses the infrastructure requirements for creation, manipulation, and delivery of information to meet the current and future needs in teaching, learning, and administration.

10.6.1 Central Computing: Mainframe

The research and best practice information in the following section supports recommendation CNI-8: Replace Mainframe.
Primary characteristics of a central computing system include:

- reliability and availability
- incremental enhancement for scalability
- large attached data storage sub-systems
- high-speed channels to data storage subsystems
- data protection
- high-speed network connections
- powerful tools for prioritizing and managing workload

The role served by mainframe-class hardware systems has changed over the past few years. Most organizations are moving away from terminal oriented applications that use proprietary network protocols. More cost-effective environments have evolved for web-based applications.

Issues for central computing resources include:

- definition of mainframe-class reliability and data protection
- total cost of ownership model to compare mainframe strategies
- development of a functional model for platform evaluation
- inclusion of platform migration costs in TCO analysis
- migration strategy for legacy applications

### 10.6.2 Network Servers

Network services include file, print, domain name lookup service (DNS), authentication, and dynamic IP address allocation (DHCP) services. Network servers can also provide application services (such as for Instructional Learning Systems) and database services. Presently there is not an accurate count of all the network servers and the services, applications, and databases they host.

All these services can be provided by Windows, Linux, or MacOS X servers. When deciding which server best performs these services, a district should take into account

- ease of use/management
- interoperability
- existing staff knowledge
- professional development requirements
- security
• standards compliance
• total cost of ownership

Issues for network servers include:
• catalog of servers, hosted applications and user base
• total cost of ownership models for platforms
• system capacity and expandability
• choice of new network server(s) to deploy to provide network services and a district-wide directory/authentication environment

10.6.3 Software Distribution and Updates

Software distribution and updates have several interconnected aspects:
• catalogue of applications, licensing structure, and authorized users
• means to automate distribution of applications and updates via the network
• means to monitor and manage application usage
• consolidation of district requirements to simplify licensing

The fundamental motivation for distribution and updates is assurance that users have the applications they need and that the applications are current. In addition, it is possible to help assure compliance with licensing requirements and to negotiate the lowest cost license for the user base. To assure cross-platform service, this system may begin as a clearinghouse to track users and applications and expanded to include automated download and installation.

Issues for implementation of software distribution and updates include:
• complete catalogue of present software and licensing
• catalogue of application requirements
• creation of a distribution clearinghouse

10.6.4 Remote Monitoring and Management

Remote monitoring and management is based on the use of the simple network management protocol for communication between a central agent and active devices. Devices using this protocol must be connected to the network but are not necessarily network devices. SNMP devices
are able to provide at least status information. As devices increase in sophistication, they can be configured and operated using remote agents. The primary advantage of this is twofold:

- Devices can announce impending failure or intermittent/unreliable operation.
- Device settings can be modified to account for changing circumstances remotely, saving time and resources.

Effective remote monitoring and management require an operations center with tools and resources to monitor and manage a diverse set of devices. This must be linked to adequate information resources to quickly identify and respond to circumstances that arise.

Issues for implementation remote monitoring and management include:

- implementation of SNMP enabled devices
- tools and systems to accomplish remote monitoring and management
- staff trained and available to accomplish monitoring and management

10.7 Network and Information Security

Network and information security is an adjunct to the data, computing, and communication infrastructure. In the K-12 environment it includes protection of users as well as protection of network resources.

Network security in a preK-12 environment that is connected to the Internet is more complex than in other types of organizations. Not only must the district contend with potentially destructive attacks from outside and within the organization, it must also prevent access by minors to material that the community finds objectionable. This is required by Children’s Internet Protection Act (CIPA) and is a requirement of the E-rate program. Security requires policy and the technical means for implementation. The district has the measures in place to prevent unauthorized access.

Fundamental to effective security is the integration of it into the culture of the district such that each individual is aware of the need for secure practices and is aware of conditions and circumstances that may lead to security problems. Many practices are little more than common sense. Some are mandated by federal laws; others are required by network systems. Taken together, they provide the environment and practices necessary for effective protection of students, staff, and information.
This requires developing a comprehensive set of policies and procedures to include:

- expectations for proper computer and network use
- procedures to detect, prevent, and respond to security incidents

Security, however, is not absolute and comes at a cost, which can be measured in dollars for hardware, software, and staff time; but it can also be assessed in terms of loss of ease of use. Cost of preventing a potential threat must be weighed against the cost of recovering from it.

### 10.7.1 Access Controls

Access controls operate at the network level for wired and wireless connections. Access controls operate at the three fundamental levels:

- access to the workstation connected to a wired network
- access to network resources including addressing for wired and wireless connections
- access to information

The first line of defense against unauthorized access is close adherence to user authentication via passwords. This provides protection against most intentional unauthorized access with malicious intent. This is accomplished by invoking workstation logon, turning on password access after inactivity, and limiting local drive sharing. Combined with this is careful attention to password selection and protection of the password from unauthorized discovery. It is also critical that protected information is not intentionally or unintentionally copied from a secure environment to an insecure environment. For example, recent compromises to national security arose because users copied sensitive information from department servers to personal notebooks for work at home.

To assure user compliance with protective measures it is necessary to strike a careful balance between protection and ease of use. Users must not believe that it is too much effort to prevent unauthorized access. Much of this belief is due to a lack of understanding about what is sensitive, what is required by law to be protected, and what the implications are for unauthorized, intentional, or accidental access to sensitive information.

Issues for implementation of access controls include:

- clear understanding of access issues
- first-line defense and response as part of user awareness
- policies and training to implement security measures
- proper balance between protection and ease of use
10.7.2 Information Security

Information security includes protection of data on workstations and servers, and prevention of unauthorized access to data via the network. Data includes information supporting administrative and learning processes, and data supporting network resources and access.

Information protection starts with the recognition that critical information exists and that either due to malicious intent or by regulation, it is necessary to protect it. The same user issues apply to information security as to access control noted above.

Beyond this are significantly more sophisticated threats and response strategies. Issues for implementation of information security include:

- proper identification of sensitive information
- policies and training to implement security measures
- proper balance between protection and ease of use
- provide necessary protection and no more

10.7.3 User Protection

User protection is focused in two areas:

- prevention of exposure of students to web content that is deemed inappropriate by community standards
- prevention of exposure to malicious code.

Protection is accomplished by channeling all traffic through a limited number of physical links, each fitted with filtering technology in compliance with district standards. Content filters monitor Web addresses to prevent requests to known inappropriate sites or specific pages and monitor returned content from unknown sites to test for specific words, concepts, or images that are deemed inappropriate. Malicious code filters scan e-mail messages in particular, but also Web content and documents to prevent damaging code from being passed to users. Generally, malicious code protection includes filters at remote e-mail servers, district e-mail servers, and local workstation e-mail agents.

All of the user protection measures can be compromised by inattentive user practice. Bypass access to the Web for e-mail or content and transfer of files via disk are the most prominent compromises to protective measures. In addition, there may still be content or malicious code that gets past the filters. Users must be aware of suspicious circumstances and the common sense measures that will prevent damage to systems and security.
Issues for implementation of user protection include:
- measures mandated by requirements
- proper balance between access and protection
- proper balance between protection and ease of use
- policies and training to implement security measures

10.7.4 Operations Continuity

The concept of “disaster/failure recovery” needs to be expanded to “operations continuity.” Information stored in computer systems supports district processes. Protecting and recovering the information is only a small part of restoring the operation of the effected process. Operations continuity is divided into four phases:
- readiness
- response
- recovery
- reconstruction

These steps provide a solid methodology for identification of critical information resources, based on support of critical processes. Methodologies using checklists and procedural manuals provide clear step-wise execution of actions that can reduce the extent of a disaster or prepare for recovery from one. Operations continuity has to plan for how users will regain their productivity at an alternate location under stressful conditions. When the event has passed, it is necessary to rebuild processes and systems, and engage the process of returning to normal.

The district has developed a disaster recovery plan for central data on the mainframe. This plan has been tested and is fully operational. There has been a partial test of continuity of process based on central data but most central data users have not implemented departmental plans to support access to central data during disaster situations. Schools and departments are presently implementing comprehensive continuity plans.

Issues for implementation of operations continuity include:
- focus on users and process to drive information requirements
- training for awareness to prevent disruptions
- training and processes for effective response to events
- comprehensive strategies for recovery of processes including reconstruction and rebuilding
11.0 DISTRICT-, SCHOOL-, AND PROGRAM-LEVEL PLANNING

Included in the Technology Blueprint are a number of Major Recommendations. The purpose of this section is to provide a summary of the research and best practices information available to support the recommendations. The major recommendations related to District-, School-, and Program-level Planning are:

- DSP-1: Design and Accept a Data-Driven Performance System to Track Implementation of Strategic Plans
- DSP-2: Integration of Web-Based School Improvement Planning Tools and Performance Management
- DSP-3: Interdependencies Management Process
- DSP-4: Web-based strategic and departmental planning and performance management
- DSP-5: District-Wide Project Management Software
- DSP-6: Manage the transition and implementation of this IT Blueprint
- DSP-7: Maintain and update IT Blueprint annually.

In support of these recommendations, the following information presents current research and best practices for the topics covered in Chapter XI—District-, School-, and Program-level Planning. To facilitate navigation of the information in this section, the following is a table of contents for this section:

- Data-Driven Decision Making and the Strategic Planning Process
- Technology in Support of School Improvement Planning
  - Data Warehouses, Data Mining, and On-line Analytical Processing
  - Benchmarking Educational Support Tool (BEST)
- Technology for Performance Management and Continuous Improvement
  - IT Infrastructure Library (ITIL)
  - Project Management Systems and Continuous Improvement

Optimizing the processes used for planning and for managing the implementation of planned initiatives will enable M-DCPS to garner the maximum potential from available resources to increase student achievement. This optimization of processes depends increasingly on data-driven decision-making and process alignment.

In addition to nationally researched approaches, the current work of the M-DCPS and the state of Florida are reflected in this body of knowledge.
11.1 Data-Driven Decision Making and the Strategic Planning Process

The research and best practice information in the following section supports recommendation DSP-1: Design and Adopt a Data-Driven Performance System to Track Implementation of Strategic Plans.

The call for greater accountability in conjunction with advancement of enabling technology has raised the expectation that data will be used in planning and decision-making. At the school level adequate yearly progress (AYP) must be demonstrated by tangible, statistically valid evidence. And at all levels of leadership facts must drive strategic planning and process re-engineering to ensure efficiency, effectiveness, and high ethical standards operational efficiencies.

Data quality and usability are key success factors. Effective decision-making often requires an analysis of data from multiple sources, e.g. financial, student information, assessments, grant program data, etc. These islands of information limit effective decision-making. It is critical that these data be aligned, validated, and integrated for reporting. This can involve the use of a data warehouse or operational data store, software tools for extraction, transformation, and loading of data, and tools for reporting and analytics. In addition to the right technology, data quality management requires the right policies, practices, and oversight. Data quality and presentation directly impact effectiveness in support of strategic planning.

Core Values and Conceptual Framework for Baldrige Education Performance Excellence Model

- Visionary Leadership – create a student-focused, learning-oriented climate with clear and visible values, and high expectations.
- Learning-centered education – provide students with opportunities to pursue a variety of avenues to success.
- Organizational and personal learning – provide a well-executed approach to organizational and personal learning.
- Valuing faculty, staff, and partners – commit to the satisfaction, development, and well-being of stakeholders.
- Agility – acquire a capacity for faster and more flexible responses to the needs of students and stakeholders.
- Focus on the future – develop a willingness to make long-term commitments to students, employees, faculty and staff, suppliers, partners, and other stakeholders.
- Managing for innovation – make meaningful change to improve services, processes, and operations to create new value for stakeholders.
• Management by fact – measure critical data and information derived from the organization’s needs and strategy.

• Social responsibility – promote responsibilities to the public, ethical behavior, and the need to practice good citizenship.

• Focus on results and creating value – use results from performance measures to create and balance value for students and stakeholders.

• Systems perspective – achieve organization-specific synthesis, alignment, and integration for successful overall performance management.

Scorecard and Dashboard Software Solutions

The district is in the process of creating scorecards and dashboards to measure performance improvement.

Scorecards will enhance the district’s ability to obtain more timely snapshots of student achievement and operational priorities. The feature will allow district employees to monitor user-set targets. Targets can be set for district-wide, school, or department. User-set targets (balanced scorecard) can be used to manage district goals and objectives. Up-to-the-minute and trend comparisons can be obtained against the targets. Additional insight can be derived through drilling-down into the data and the reports to understand the reasons behind the data.

Dashboards will allow for the graphical presentation of the data. The clarity and understanding of the data can be enhanced visually using maps, charts, and gauges. Multiple data streams can be presented together for greater visual comparisons. Dynamic dashboards are drillable to external data sources for greater data integration.

The Office of Performance Improvement is in the process of providing dashboards and scorecards for schools and departments to measure key performance indicators. Dashboards and scorecards with operational plans and action steps are in the process of being implemented. The end user/analyst data warehouse tool that is being purchased will provide dynamic updates to dashboards and scorecards.
11.2 Technology in Support of School Improvement Planning

The research and best practice information in the following section supports recommendation DSP-2: Integration of Web-Based School Improvement Planning Tools and Performance Management

Technology can play a significant role in supporting the alignment of vision, mission, and goals (a key concept in M-DCPS’s Performance Excellence Paradigm). Online planning tools have been proven effective for school improvement planning and technology planning. Miami-Dade County Public Schools is one of many districts across the country that takes advantage of online tools for school improvement planning. In large district a key benefit is that the online template promotes a consistent planning model aligned to local, state, and federal mandates. Using an online process also facilitates oversight for review and approval of site-based plans.

A best practice in delivery of online planning is the use of data to drive the decision-making process. At one level disaggregated data (student assessments, attendance, mobility, staff certification, etc.) is presented as part of a needs analysis phase. These reports presented within the online tool help school advisory council and school leaders identify and prioritize needs. The next level uses embedded logic to flag and highlight needs identified in the data as high priority and automatically populate the plan. This can include validation logic to ensure the plan includes interventions to address specific AYP indicators when developing plan interventions. Such logic can prevent planners from submitting the plans for online approval until needs indicated by the data are address.

11.2.1 Data Warehouses, Data Mining, and On-line Analytical Processing

Competitive advantages, profitability, and efficiency is maintained through the proper integration and management of data warehouses. Data are collected from a variety of sources throughout the organization–call centers, sales, and inventory management. As data are collected, they are passed through a data life cycle management (etc., meta-data repository; extract, transform, and load (ETL); data warehouse; and OLAP) as follows:

- Pre-data Warehouse – designers and administrators determine which data contain business value for capture
- Data cleansing – data are checked for quality/errors
• Data repositories – data marts or operations data stores (ODS) are used to store active business data
• Front-end analysis – data mining, OLAP, and data visualization applications are utilized to interact and display data from the data repositories.

11.2.2 Benchmarking Educational Support Tool (BEST)

The Office of Performance Improvement offers the Benchmarking Educational Support Tool (BEST) from the Council for Educational Change, a “software application providing current and historical demographic and academic data aiding in the decision-making process to improve student achievement. Specifically, BEST provides stakeholders with rapid access to a vast array of information necessary for effective assessment of the performance of the school so efficient use of available resources is made.”

The software “uses computerized searches into district and statewide databases of schools’ demographic, assessment, and achievement data. Specific data relevant to each individual school can be displayed and printed in tabular as well as graphic formats.”

“In addition, the software enables the user to identify demographically comparable schools and display all relevant data; thus, providing schools with the opportunity to comparatively analyze their own school’s performance and to develop networks and schools of similar demographics for the purpose of sharing educational strategies.”

11.3 Technology for Performance Management and Continuous Improvement

The research and best practice information in the following section supports recommendation DSP-3: Interdependencies Management Process

In contrast to centralized analytics, there is a current trend toward technology to support “Business Intelligence”. This BI technology moves the value of data-driven decision support out of the central office and into all levels of the organization. In the business world this technology has meant enabling middle managers and line workers on the factory floor or customer service call centers with performance management tools, including scorecard and dashboards and real-time decision-making tools for improved productivity and quality.

In K-12 education the technical and philosophical evolution of business intelligence can mean principals and teachers have access to information and tools that can dramatically improve teaching and learning. Instead of analyzing data behind closed doors, and passing reports down to schools, now classroom
instructional decisions can be made in near real-time based on a common data analysis framework, common key performance indicators and common metrics used throughout the district. The potential of accurate and consistent instructional decision-making is much greater when instructional staff have accurate information along with a common framework for interpreting and acting on that information. Technology for performance management can transform the planning function at all levels of the K-12 enterprise into a dynamic process for continuous improvement.

11.3.1 IT Infrastructure Library (ITIL)

The district’s ITS has adopted and is implementing the IT Infrastructure Library (ITIL) for management of IT services, starting with change management. Additional areas covered by ITIL are Incident Management, Problem Management, Release Management and the Service Desk. ITS is reviewing the implementation of the standard for other IT services. Developed in the late 1980s by The government Central Computer and Telecommunications Agency (CCTA) of the United Kingdom (UK), ITIL has become the worldwide de facto standard in service management. Its focus is to provide quality improvements through the delivery of IT services. The quality of service is directly linked to the expectations of the client, the IT department, and the budget. Processes are integrated to each other so that each one meets its goals. ITIL defines the links between each of the processes, to take the guesswork out of determining how they are related. ITIL is a vendor-independent, best practices approach to IT services, which addresses the following processes:

Operational Layer

1. Configuration Management
2. Service Desk Management
3. Incident and Problem Management
4. Change Management
5. Release Management

Tactical Layer

6. Service Level Management
7. Availability Management
8. Capacity Management
9. Continuity Management
10. Financial Management
11.3.2 Project Management Systems and Continuous Improvement

The research and best practice information in the following section supports recommendation DSP-4: Web-based strategic and departmental planning and performance management

The district does not currently utilize a Web-based planning tool for developing departmental and strategic plans. The Web-based tool is temporarily off line. The district is also using a mainframe-based project management system. Management reporting and measuring tools are needed.

The research and best practice information in the following section supports recommendation DSP-5: District-Wide Project Management Software

Project management can be defined as a set of well-defined methods and techniques for managing a team of people to accomplish a series of work tasks within a well-defined schedule and budget. The techniques may include work breakdown structure, workflow, earned value management (EVM), total quality management (TQM), statistical process control (SPC), quality function deployment (QFD), design of experiments, concurrent engineering, Six Sigma etc. Tools include flowcharts, PERT charts, GANTT charts (e.g., Microsoft Project), control charts, cause-and-effect (tree or wishbone) diagrams, Pareto diagrams, etc. (Note that the balanced scorecard is a strategic management, not a project management technique).

The district is using mainframe-based project management systems that have limited capabilities. Implementation, management reporting, and measuring tools are needed. The district is currently reviewing Web-based project management systems. The software must support milestone tracking, dependencies, and resources that allow projects to be monitored via the Web, and usable as a data repository for all district projects, including departments not using the software so that it can be the source of key performance and information indicators for all district projects.
12.0 COMMUNITY ACCESS AND PARTICIPATION

Included in the Technology Blueprint are a number of Major Recommendations. The purpose of this section is to provide a summary of the research and best practices information available to support the recommendations. The major recommendations related to Community Access and Participation are:

- CAP-1: Increase Community Access to School Board Information
- CAP-2: Building e-community
- CAP-3: South Florida Career Connections
- CAP-4: Extended learning through technology
- CAP-5: Leveraging old and new media
- CAP-6: Connecting with Volunteers

In support of these recommendations, the following information presents current research and best practices for the topics covered in Chapter XII—Community Access and Participation. To facilitate navigation of the information in this section, the following is a table of contents for this section:

- Miami-Dade County School Board
- Home/School/Community Connection
  - Information Dissemination and Communication Strategies
  - Alternative Schooling
- Connecting School-to-Career
  - School-to-Career Programs in M-DCPS
  - Certification Programs
  - Internships and Apprenticeships
  - Other School-to-Career Connection Strategies
- Community Learning Programs
  - Extended School Day
  - Expanded School Programs
  - Community Learning Centers
- Public Information and Awareness
  - Print Publications
  - Web Communications Strategies
  - e-News
  - TV and Radio
  - Public Awareness Campaigns
The federal No Child Left Behind (NCLB) legislation requires that schools and districts across the nation invest their federal funds for student achievement on strategies that are scientifically proven best practice. Making technology resources available to the greater M-DCPS community will help build support and buy-in from the tax paying public. The following information presents current research and best practices for the topics covered in Chapter XII. *Community Access and Participation*. These topics include:

- Home/School/Community Connections
- Connecting School-to-Work
- Community Learning Programs
- Public Information and Awareness
- Community Involvement

In addition to nationally researched approaches, the current work of the M-DCPS and the state of Florida are reflected in this body of knowledge.

### 12.1 Miami-Dade County School Board

**Electronic Agendas**

The research and best practice information in the following section supports recommendation CAP-1: Increase Community Access to School Board Information

Board members are inundated with paper. They have made a commitment to e-agenda software that allows departments to create and publish agendas through a web-based interface. An evaluation and selection of an electronic document management system is important to reduce large notebooks and have web-based archival and relevant web sites data available.

### 12.2 Home/School/Community Connection

M-DCPS strategic plan and preliminary technology recommendations emphasize a commitment to connect with the community. In its Strategic Plan, M-DCPS Goal III states it will actively engage family and community members to become partners in raising and maintaining high student achievement. M-DCPS’ Education Web pages provides relevant information for parents and students.
The parent portal has a set of links that support parents in helping their child succeed in schooling including:

- Helping Your Child Series from the US Department of Education
- Helping Children Succeed in School from the University of Illinois
- Helping Your Child Learn form the national PTA
- Parent Power from the National Education Association
- FACTS Org provides online transcripts for high school students and parents
- Promotion/graduation requirements
- M-DCPS curriculum
- Home resources
- Parent groups
- Policies

Language is an issue for the Web site. English, Spanish, and Creole are needed on most communications, starting with the Districts Website, where only some items are translated. A language translation capability into Spanish and Creole for major community documents and programs should be implemented. This will support Strategic Goal II to develop students so they are able to successfully compete in the global economy.

12.2.1 Information Dissemination and Communication Strategies

The research and best practice information in the following section supports recommendation CAP-2: Building e-community.

A strategic, district-wide information dissemination and communication plan is critical to the success of any large school district today. Such a strategic plan needs to address the technology that makes home/school/community connections possible. A strategic communication plan must also address staffing and processes. While many perceive information dissemination and communications as a one-way street from the district to the community, a comprehensive strategic plan actually focuses on two-way interactions.

In today’s environment the Internet is the technology tool of choice to facilitate an Information Dissemination and Communication (ID&C) strategy. Yet other technology-based media are also available: WLRN radio and television, voicemail, and preliminary use of podcasting and other new technologies.
District and School Websites

Community members and the world at large have access to information about every school in the district through the Internet. Through the district's main Website, http://www.dadeschools.net, community members can learn how to contact a school, see a school's boundaries, get enrollment information, or download a copy of the School Improvement Plan. In addition, the district Website is linked to each school's own Website.

School Improvement Zone Websites

A recent project for the 39 School Improvement Zone schools to develop a ZONE branded web sites to provide easy access to up-to-date and accurate information. It is important that end users are able to count on access to a standard set of information and functionality on every school web site, even if the look and feel is adapted to reflect the individual character of the school. If a student changes school, his or her parents can find the same critical information on new school’s web site as they did on the previous school’s site. This project enabled each zone school with a capability to update and manage content on their own web sites. Finding the most critical information about a school is easily accomplished because of the consistent layout and navigational tools provided.

WLRN Radio and Television

Using the Distance Learning facilities of WLRN, the district's television station, and the Internet, teachers are taking classes online and learning from experts in various fields through videoconference classes. WLRN’s Distance Learning programs consist of a virtual online component, a videoconference component, and Web-streaming.

Dade Virtual Education is franchised from the Florida Virtual School. All courses are based on Sunshine State Standards, and the rigorous curricula are directly linked to the benchmarks established by the Florida’s Department of Education.

Distance Learning courses offered include elementary and middle school programs in diversity and FCAT preparation in reading, writing and math. Students and teachers in all grade levels participate in videoconferences with other students all over the world and take field trips to distant lands, tour museums, and visit other places of interest.

WLRN’s videoconferencing programs support the elementary, middle, and high school curricula as well as other special videoconferencing programs. From WLRN’s Website one follows links to the elementary and middle school academic classes that include lesson plans, class
schedules, pictures, information, and teacher resources. The other special videoconferencing programs transform the classroom into an environment where interactive learning is extended into a world of global learning. Students participate in fieldtrips outside of Miami-Dade County, special programs, and special events.

WLRN Distance Learning offers several types of video technologies, ISDN, IP videoconferencing, and Web-based conferencing that are clearly explained on its Website, wlrnitv.dadeschool.net. Teachers, administrators, and other district personnel teach, learn, and conduct meetings using two-way, interactive videoconferencing available through facilities at schools and at WLRN.

WLRN Distance Learning Web-streaming capabilities include Web-cast programs, classes, and Virtual Education courses for the desktop computer. State-of-the-art Web-streaming technology delivers TV-quality programming that can be viewed by many audiences at anytime on the desktop.

12.2.2 Alternative Schooling

Florida state law requires M-DCPS to provide alternative schooling services as an option to students in Miami-Dade County. M-DCPS currently supports several alternative schooling options for its students. Connecting with any of these programs in ways that are legally viable can be both politically and fiscally profitable to the M-DCPS.

Charter Schools

Charter Schools were authorized by state statute in 1996 as an integral part of the state’s program of public education. The statute defines how and why a Charter School can be formed. The statute states:

“A charter school may be formed by creating a new school or converting an existing public school. The purposes of a charter school are to:

- improve student learning
- increase learning opportunities for all students, with special emphasis on expanded learning experiences for students who are identified as academically low achievers
- encourage the use of different and innovative learning methods
- increase choice of learning opportunities for students
- establish a new form of accountability for schools
require measurement of learning outcomes and create innovative measurement tools
• make the school the unit for improvement

In addition, the statute establishes those who may submit proposals and limits the number of charter schools a district may establish. It also clarifies civil-rights related issues in order to accommodate any student residing in the district.

Hospital/Homebound

The Homebound Program is an essential service for children who cannot attend classes because they are medically fragile or by family preference. Individualized instruction in the home by a qualified teacher provides a foundation for the child’s success in the future.

The Hospital/Homebound Program, based at the Merrick Center, is a program for students who have a medically diagnosed physical or mental condition which confines them to home or hospital and whose activities are restricted for an extended period of time.

The mission of the hospital/homebound program is to provide quality education for those students confined to home or hospital in grades pre K through 12. This is accomplished through a positive learning environment, emphasizing individualization, flexibility, modifications, and support structures in order to promote a continuum of learning experiences while facilitating the successful re-entry to their home school.

Each hospital/homebound student is assigned a home teacher, who “visits” the student at least once a week either one on one or via the telephone at a prescribed time (in a teleclass). The teacher, who is certified in a specific subject area, conducts the class with the use of visuals from work packets, videos, and textbooks. During these visits the home teacher will reinforce and assist a student’s academic growth while monitoring tests, maintaining student records, and collecting written assignments.

Miami-Dade’s teleteaching system currently provides a variety of secondary teleclasses and has the capability of serving as many as xx students at a time in the same class. Historically, however, classes average fewer than the maximum (5-10 students.) This low teacher-student ratio allows students the opportunity to benefit from the more personalized learning situation. Students are graded on a daily basis, according to participation in the teleclass, exams, homework, and class assignments. Final exams for high school students are taken onsite at the hospital homebound office.
Home Schooling

Several groups in Miami-Dade County support home schooling. Contact information for these groups is provided below:

League of Jewish Homeschoolers
Based in South Florida
Email: dvorah@chayas.com
http://www.chayas.com/homeschoolindex.htm

Home Education Florida (Source: Independent Education and Parental Choice - Home Education) Home Education is a parent-directed education alternative. Home Education allows the freedom to explore and learn at the pace of the individual student. A Home Education Program, as defined in Section 1002.01(1), F.S., is the "sequentially progressive instruction of a student directed by his or her parent or guardian."

Further resources for home-schooling in Florida can be located at http://www.floridasmart.com/education/homesch_fl.htm.

12.3 Connecting School-to-Career

Many years ago the Federal government emphasized and funded school-to-work programs in order to better prepare young people to enter the workforce immediately after completing high school. The number and variety of school-to-work programs are regularly changed or modified to meet the needs of both students and businesses in a geographic region. Miami-Dade has reaped many benefits from the programs offered through M-DCPS.

12.3.1 School-to-Career Programs in M-DCPS

The research and best practice information in the following section supports recommendation CAP-3: South Florida Career Connections.

The Department of Career Preparation at M-DCPS provides students with a variety of school-to-career opportunities. The mission is “to assist all students in finding real-world applications and opportunities for their education, increase awareness of career choices, access student interests and aptitude for making informed decisions about career goals, and to fulfill citizenship responsibilities.” Specialized programs and services include:

- Technical education
- Centers of Excellence partnership program

• Industry Services Training Center
• Apprenticeship Programs

The Department of Career Preparation also provides programs for high-school students to improve their academic and technical skills. These programs include:

• **Summer Transitions**—In conjunction with Brandeis University, this program is a six-week program in math and science for economically disadvantaged students.

• **In-School Youth Program**—assists the transition from school to work for economically disadvantaged students in 11th and 12th grades.

• **Summer Training and Academic Remediation (STAR)** program provides remediation services for economically disadvantaged students who are paid (minimum wage).

Community-based partnerships assist the district with providing internships, visitation sites, interview experiences (both in person and via video conferencing), exposure to state-of-the-art technologies in their chosen field, and hands-on experiences in a real-world setting in the career and technical education programs.

### 12.3.2 Certification Programs

Schools have been offering certification programs in such labor markets as auto mechanics, welding, plumbing, construction and electricians. Certification programs in the higher-paying technology specialties have been added to these and other school-to-work programs.

*Cisco, Novell, Microsoft Certification*

Many corporations offer education programs for K-12 schools as a way to increase the number of skilled workers who can support their products. Some of these corporations in collaboration with the schools certify that students who complete the program are qualified to enter the workforce as a skilled technician. Opportunities abound in the greater Miami area for certification by Cisco, Novell and Microsoft. These courses are delivered both online and in the classroom by instructors authorized by each of the companies. Fees are charged for certification preparation classes and fees are charged to take the test. These classes are available at most high schools.

A program possibly suited to Miami-Dade schools is the Dell TechKnow program. Although not classified as a certification program, Dell
TechKnow is a tool for school districts to engage low-income middle school students in an innovative after-school program for technology education. During the after-school time, the students gain technology skills by taking apart and building their own computers, while giving them confidence and resources to take home to their family. The program adopted by the Texas Computer Education Association can be used as a model for Miami-Dade schools, located at [http://www.tcea.org/delltechknow/](http://www.tcea.org/delltechknow/). The program originated at Dell Corporation as one of their K-12 education programs and solutions ([http://www.dell4k12.com/programs.php](http://www.dell4k12.com/programs.php)).

**Student Technology Leadership Programs**

Student Technology Leadership Programs have become critical to the level and extent of support for technology that exists in a school district. Such programs not only do prepare young people to reach standards of excellence, but they also prepare them to perform tasks of service to their fellow students and school personnel. Their technical skills and service qualities transfer to their lives beyond the schools. Several programs that prepare high school students to serve as technology leaders include:

- Generation Y (Gen Y)

- Student Technology Leadership Program (STLP) supported by the Kentucky Department of Education

- The Student Technical Support Course at the Kent School District, Kent, WA.
  [http://www.kent.k12.wa.us/KSD/IT/alliance/techleadership.htm](http://www.kent.k12.wa.us/KSD/IT/alliance/techleadership.htm)

- Student Leadership Program at Dover-Sherborn Regional Schools
  [http://hs.doversherborn.org/technology/satl.htm](http://hs.doversherborn.org/technology/satl.htm)

Only Gen Y will be described because it has received recognition as a model for technology infusion. Follow the links above to find descriptions of the other programs.

**Generation Y: A School-wide Model for Technology Infusion**

This innovative program began as a Technology Innovation Challenge Grant in the Olympia school district in Washington State in 1996. “The vision was to include students in the effort to infuse technology into curriculum and schools. After six years, the program is not only still going...

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strong in Olympia, but has also spread to hundreds of schools throughout the country,” reports the website.

The Gen Y Model as emulated by other programs around the country is as follows: “The heart of the program is a Gen Y class. Each student in this class is paired with a partner-teacher at the school. Each of these student-teacher teams then decides what lesson plan, curriculum unit, or other school need will be addressed by a collaborative, technology-enriched curriculum project, which the partner-teacher and the Gen Y student produce together. In the Gen Y class, the student not only learns the technology skills necessary to complete the project, but also soft skills, such as planning and collaboration, necessary to complete the authentic, long-term project. The result is authentic, project-based learning for the students and sustainable technology professional development for the teachers. This powerful model has been refined and proven in real classrooms around the world.”

Generation Y offers: proven results by empowering students with technology skills enough flexibility to be developed in a variety of school environments; a train the trainer model that is cost effective; and a return on investment by building a community of technology users at the school level. Success stories about Gen Y can be obtained from the Website, http://www.genyes.org/products/geny/genysuccess.

12.3.3 Internships and Apprenticeships

Supt. Rudy Crew has stated his interest in having all students participate in an internship before graduating from high school. Schools currently seek ways to enrich a student’s learning through internships and partnerships with other organizations and institutions. Internships and partnerships often emerge from federal and state grant programs. Many internships evolve from partnership with an Institution of Higher Education (IHE). Two examples are the Math and Science Partnership (MSP) and Project Lead the Way (PLTW).

Math and Science Partnership Program

The National Science Foundation (NSF) and the U.S. Department of Education launched the Math and Science Partnership (MSP) program in fiscal year 2002, making $172.5 million available for the FY 2002 competition. The challenge of the MSP was “to increase the capacity of K-12 educational systems and institutions of higher education to provide the requisites for learning to high standards in science, engineering, and mathematics while being attuned to reducing gaps in achievement among student populations.”

A defining feature of the MSP program is the development and implementation of productive partnerships among major stakeholders in
K-12 mathematics and science education; each partnership requires commitments from one or more school districts and one or more higher education entities. Partnerships also are encouraged to include other partners, such as state or tribal government agencies, science centers, museums, businesses, and community organizations that bring additional assets to K-12 teaching and learning.

“The qualities of a truly effective and sustainable partnership are relatively easy to describe but hard to achieve,” according to Dr. Judith Ramaley, Fall 2002. The MSP Tool kit on the MSP Website describes three stages to achieving an effective K-12/IHE partnership: 1) developing, 2) implementing and 3) sustaining. Each stage has six elements: 1) goals, 2) strategies, 3) roles and responsibilities of partners, 4) communication, 5) operations, and 6) feedback and self-monitoring. For each element, essential steps are outlined, followed by a list of common pitfalls. To have a successful partnership, one must complete the steps while avoiding the pitfalls. The checklist at the end of each stage is helpful in determining areas needing attention.

**Project “Lead the Way”**

Project Lead The Way® (PLTW), [http://www.pltw.org](http://www.pltw.org), is a not-for-profit organization that promotes pre-engineering courses for middle and high school students. PLTW forms partnerships with public schools, higher education institutions and the private sector to increase the quantity and quality of engineers and engineering technologists graduating from the nation’s educational system.

The PLTW curriculum was first introduced to 12 New York State high schools in the 1997-1998 school year under the leadership of Richard Blais, then Technology Director of an upstate New York school district. A year later, PLTW field tested its four-unit middle school program in three middle schools. Today, the programs are offered in 600 schools in almost 40 states. As presently structured, there are eight courses in the PLTW High School Pre-engineering Program. The PLTW Middle School program, Gateway To Technology, consists of ten-week, stand-alone units which can be implemented in grades 6–8, as determined by each school.

One can explore the PLTW Website for more information on the curriculum, implementation, school certification and college credit for teachers and students, and much more.

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**eMentoring**

Electronic mentoring or “e-Mentoring” applies technology to the mentoring process. People who are mentors can receive support from the National Mentoring Center (NMC). NMC, a project of the Northwest Regional Educational Laboratory (NWREL) and funded by the Office of Juvenile Justice and Delinquency Prevention (OJJDP), assists mentoring projects in developing and implementing evidence-based programs through the training and technical assistance activities, information services, the development and dissemination of a variety of print publications, and by conducting special projects in collaboration with OJJDP. The NMC also works with federal and state agencies as well as other national mentoring organizations to ensure the delivery of high quality, coordinated youth mentoring services at the community level.

Starting a mentoring program requires a planning process that involves a lot of work and numerous resources. The mentoring tool kit can be downloaded from the Website [http://www.nwrel.org/mentoring/topic_startup.html](http://www.nwrel.org/mentoring/topic_startup.html). The ToolKit thoroughly describes the steps from beginning to end. Using electronic communications to support mentors in a mentoring program classifies it as an e-mentoring program.

The following questions (from the Mentoring Tool Kit) warrant answers before entering the mentoring program planning process:

- Who are the children to be served?
- What impacts on their lives does the program want to make?
- Who will the mentors be?
- Where will the mentoring take place?
- What resources (time, money, staffing) are necessary?
- What existing programs already serve or could potentially serve these youth?
- Who will assist staff in developing the mentoring program?

The planning steps include the following:

- conduct a needs assessment to determine the unmet needs that the new program can address
- create an advisory council or steering committee that will ensure that the program is moving in the right direction meeting the needs of everyone involved

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• develop a mission statement that reflects the diverse voices and needs of all program stakeholders, including the youth and the community such a program will serve

• write a program proposal that clarifies issues about funding and resources needed

• write a resource development plan that includes goals and objectives, strategies, timelines, and assigned responsibilities for making the plan happen

• implement a mentoring Program that includes policies and procedures for:
  1. recruitment and marketing strategies
  2. eligibility criteria
  3. screening process
  4. orientation and training
  5. matching process
  6. monitoring and supervision
  7. recognition of mentors

One can review the paper on effective practices in mentoring programs to further ensure that a program is on the right track.

Executive internship

Offered to high school students who are college-bound, these try to match students with internship experiences in professional fields, such as law, engineering, public relations, aviation, and others. Students leave school an hour or two early to spend from two to five hours at the internship. The goal is that they get early exposure to career fields and some one-on-one attention from a professional in that field, thus encouraging them to work hard in school and follow a path that will result in a professional career. This is a distinct program from cooperative education, which tends to emphasize entry-level positions for students who will start working right after high school.

Attempts to locate and partner with companies with a technology focus (hardware, software, services) would expand the opportunities for students to gain early exposure to high paying technical jobs. Some students can follow up with a high paying part time position during college years.
12.3.4 Other School-to-Career Connection Strategies

When initially funded, School-to-Career programs became integral to vocational education programs in secondary schools. But the model has been reworked and changed. Other strategies can be considered. Supt. Rudy Crew has indicated his desire to reshape schools such as Miami Edison Senior High School with themed academies.

As the global workforce has changed, so has the definition of the well-prepared worker. According to the Bureau of Labor Statistics, the number of skilled jobs rose 45 percent from 1950 to 2000. These skilled jobs require more specialized training than a high school diploma, but not necessarily a four-year college degree. The U.S. Department of Labor asserts, "Another challenge is the long-term shift from goods-producing to service-producing employment associated with a dramatic increase in the demand for knowledge workers–people whose jobs require formal and advanced schooling. Knowledge workers now account for a third of the American workforce, outnumbering factory workers two to one." This fact alone calls for a dramatic change in the way we prepare students for their futures.

The January 2004 issue of *Tech Learning* included an article by Barry Burke titled "School to Career: Reworking the Model." The article included the statistics from the Bureau of Labor Statistics about today’s workforce. According to Mr. Burke, the school-to-career model has changed because vocational education has changed from focusing on preparing students for industrial jobs to focusing on technology education. He says that it is the high school's mandate to both train and teach all students through programs that pair technical training with higher-order thinking skills.

The example used by Mr. Burke describes how 30 years ago, students in auto mechanics classes learned how to fix a car. In today's auto technology classes, they blend practical skills with more complex thought, applying math concepts, for instance, to problems in an automobile's electrical system. By the same token, the straightforward drafting or architecture courses of the past have become a CAD (computer-aided design) training ground, where students apply geometry, physics, design constructs, and material science to make decisions about roof shapes and the best materials to resist weather.

With the increasing size of high schools, smaller learning communities have been devised for more effective learning. Mr. Burke stresses how smaller learning communities work effectively in the Montgomery County Public Schools (Rockville, MD) where he serves as the Director of Career and Technology Education.
Career clusters are the foundation of the smaller learning communities and are grouped by common academic and technical skill sets needed for post-secondary education and employment in each category. The model supports a blending of the rigorous academic and applied learning tracks to ensure that all students have a sense of the opportunities in their future and are prepared to pursue those interests upon graduation from high school. These career clusters provide the basis for developing smaller learning communities around career-themed programs in high schools, and a continuum of themed activities in middle school.

For a sampling of cluster topics, see Montgomery County Public Schools Career Clusters at http://www.techlearning.com/story/showArticle.jhtml?articleID=17300810&pgno=4.

Mr. Burke outlines several suggestions for restructuring schools into smaller learning communities:

- Recognize the need for school-wide change: Through exposure to models in the National Academy Foundation, which offers built-in programs that schools might customize to their individual needs, the principal can see the components of a successful model.

- Involve the community: As with any team-building exercise, the principal must engage the community to get its feedback.

- Build staff capacity: Teachers and building support staff are critical to the success of the initiative.

- Identify appropriate career themes and challenges: For some schools, the biggest challenge may be the physical layout; for others, the challenge may be in scheduling seven different career cluster academies in the same building.

- Develop advisory boards around the career themes: The advisors will help guide the development of blended instruction, give advice on course content and structure, and provide work-based opportunities for students throughout their high school experience.

- Focus on professional development: The blending of instruction between academic and technical teachers is probably the biggest challenge. Bringing the two methods of instruction together to create a program of study that includes all the courses necessary to graduate is a mind shift that all teachers must make in order for the academy to be successful.
Mr. Burke concluded his article: “The academy approach with its incorporation of the practical and the conceptual is one of many models that focus on teamwork, individual responsibility, and a personalized educational experience. With these skills as a basis, it is likely students will enter the workforce armed with assurance, the ability to apply knowledge, and a realistic idea of what it takes to succeed.”

For additional information and descriptions of each defining feature of a career-themed academy, visit the Maryland State Department of Education Website [http://www.msde.state.md.us](http://www.msde.state.md.us).

### 12.4 Community Learning Programs

Miami-Dade County Public Schools supports many learning programs offered around the community. However, most of them do not communicate well with schools. By improving connections between the community learning programs and the schools, the county can avoid duplication and overlap of programs. Then, students can readily identify what programs are available and suited to their needs.

#### 12.4.1 Extended School Day

The research and best practice information in the following section supports recommendation CAP-4: Extended learning through technology.

Many students already attend after-school activities for athletics and the arts. Also many students need supervision after school while their parents work. As many as 15 million children have no place to go after school, and these children are more likely to be victims of crime or to participate in risky behaviors. To benefit, the greatest number of children, before and after school programs should be affordable and of high quality. M-DCPS has 205 after-school programs, and other after-school programs are offered by for profit, nonprofit groups and also through The Children’s Trust.

A technology component can be included in these programs. This may assist students in mastering curriculum content, use technology to produce original works, or expose them to potential career areas. The district has licensed much electronic content that can be used by students in the extended school day, without incurring extra software or licensing costs for the after-care provider.
After School

A national program called the Afterschool Alliance is a non-profit organization dedicated to raising awareness of the importance of after-school programs and advocating for quality, affordable programs for all children. It is supported by a group of public, private and non-profit organizations that share the Alliance's vision of ensuring that all children have access to after-school programs by 2010. The Alliance believes that children in after-school programs have improved grades, behavior, and school attendance, since they have important opportunities to learn and grow.

The Alliance was created to conduct public awareness and advocacy work for increasing program quality and moving toward long-term sustainability of after-school programs. The Alliance grew from public awareness efforts undertaken by the Mott Foundation through an unprecedented, public-private partnership with the U.S. Department of Education to expand after-school programs through the 21st Century Community Learning Centers after-school program. The federal government provided grants to local communities for after-school programs while the Mott Foundation funded training, evaluation, and public-awareness activities. The Foundation and the Department's efforts caught the attention of several outside entities with a shared interest in achieving after-school for all. These groups came together in September 1999 to create the Afterschool Alliance.

Today, the Alliance works with a broad range of organizations and supporters, from advocacy groups and after-school providers (including the 21st Century Community Learning Centers) to business and philanthropic leaders, and technical assistance organizations.

After school programs through The Children's Trust, churches and other groups

Created after voters agreed to tax themselves for 10 years, generating about $60 million a year, The Children's Trust offers after-school programs through other agencies. One, New Horizons at the Community Mental Health Center, serves a difficult population of students who have a psychiatric evaluation and often also are ESE students. No other after-school program is led by a licensed psychologist who has experience dealing with children from difficult backgrounds. New Horizons requested and purchased about 10 computers to use with the students. When full Internet access is available for all the computers, students in the New
Horizons after-school program will be able to access instructional and reference materials that have been paid for by M-DCPS licensing. The students in this after-school program are unlikely to have a computer at home or a parent who knows how to use one. In addition, parents of limited income are unlikely to have disposable income for Internet access or software. Thus, after-school programs like the one at New Horizons offer an opportunity for students to bridge the digital divide, have more time to use instructional technology materials, and become confident in technology uses.

Another after-school program is supported by a church in downtown Miami in the shadow of I-95, the Greater Bethel AME. In this program, computers are available for children after school, on Saturdays and during the summer. At night adults are able to attend training sessions and use software on these computers. Staff at the site were not familiar with the Riverdeep materials, but the students in the after-school knew how to access the materials once given permission to use them.

These two examples of after-school care, where a non-school agency has acquired computers and Internet access, are potent examples of opportunities for the least affluent students in the district. They can provide an opportunity to extend the school day and increase use of web-based materials that are already licensed by the district. Rather than have students play Solitaire or Freecell in after-school programs, the students can use instructional materials and benefit.

**Summer School**

Many technology courses and programs are offered during the summer months by both M-DCPS and non-M-DCPS groups and organizations. These courses provide remediation and enrichment.

In the summer of 2003, using state funds, M-DCPS purchased LeapFrog SchoolHouse materials for use by primary students in summer school. The school division of Learning Village creates and tests PreK-8 multisensory classroom learning programs and research-based assessment and curriculum content. LeapFrog SchoolHouse was established in response to requests from teachers to customize LeapFrog home technology and educational programs for use in the classroom. Because students learn best when they are fully engaged, the LeapFrog SchoolHouse enables students to learn by seeing, touching, and hearing in curriculum areas of reading, language arts, math, science, and social studies. By making the LeapFrog SchoolHouse materials available in the summer, on-going learning for young children is supported by the M-DCPS.
Tutoring

Tutoring can provide either remedial or enrichment activities for a student. Tutoring traditionally has been face-to-face one-on-one with the student or in small groups. Now tutoring can occur online or with tutorial software on a computer. Some tutoring is provided through district-licensed software, such as Riverdeep for mathematics, reading and science.

An example of online tutoring for Miami-Dade residents is Atomic Learning. While the majority of the tutorials on how to use software are in English, a number of tutorials are also in Spanish.

Atomic Learning offers online tutorials anywhere anytime wherever there is an Internet connection. Atomic Learning is a series of video tutorials that provide assistance in learning how to use curriculum and productivity software. These instructional tutorials can be accessed any time, day or night, via the Internet. Atomic Learning videos are appropriate for beginning, intermediate, and advanced users.

The approach and tone of the resource materials support problem-based learning and model best practices for learner-centered, hands-on learning. Learn how to use CAB E-mail, AppleWorks, Fireworks, Flash, Front Page, iDVD, iPhoto, iTunes, iMovie, MAC OSX, Dreamweaver, Microsoft Word, Excel, PowerPoint, and much, much, more. Atomic Learning lesson plans will soon be aligned to the NETS Standards.

12.4.2 Expanded School Programs

Academic programs reach beyond school walls when they are offered in school facilities at times when they do not interfere with the normal school programs. The school’s learning resources are made available to learners of all ages. Miami-Dade County hosts adult learning programs in community schools and several adult centers. A federal grant has paid to work with immigrant parents in Spanish and Haitian Creole on topics to help them and their children to succeed. In addition, the new Parent Academy focuses on skills for parents.

GED (General Education Development)

The GED is a door to new opportunities. Many GED graduates attend community colleges or universities. Programs are offered to fit busy schedules, and students work at their own pace with students from different generations, races and countries.
The first General Educational Development (GED) tests were developed in 1942 to measure the major outcomes and concepts generally associated with four years of high school education. Begun by the United States Armed Forces Institute (USAFI), the original tests were given only to military personnel so that returning World War II veterans could more easily attend a college or vocational school even if they had not completed high school before serving in the military.

Since that time, the GED test has become an accepted means of awarding a high-school diploma. All 50 states, the District of Columbia, and 11 Canadian provinces use scores earned on the GED tests as a basis for awarding high-school credentials.

Miami-Dade County Public Schools tests students everyday of the week, year round. This year M-DCPS takes pride in a 75% passing rate. Recent national surveys confirm that most employers and training programs consider applicants who hold a GED diploma in the same manner as those who hold traditional high-school diplomas. Most colleges and universities admissions guidelines call for acceptance of GED score reports instead of complete high-school transcripts. The GED diploma is the key to open many doors to a new career and lifestyle.

**Miami-Dade Adult and Community Education Classes**

Adult and community education classes are offered throughout the county in community centers, community schools, technical centers, or education centers. The varieties of classes foster lifelong learning for adults. ESOL is also a very popular series of classes. In addition, some computer classes are taught in Spanish.

### 12.4.3 Community Learning Centers

Community learning centers have existed in Miami-Dade for years. Their offerings are being expanded to include technology support and instruction to members of the community.

**Community Technology Center**

Community Technology Center (CTC) Initiatives provide new opportunities for individuals to upgrade their skills so that they can move into post-secondary education or advanced training, in order to obtain better-paying jobs. Technology-based instruction increases adult participation by providing learning opportunities at convenient times and locations. Instruction is individualized to suit different learning styles, interests, and levels of mastery. Learning time is used more efficiently, enabling adult learners to move at their own pace. In some cases, technology-facilitated instruction helps students learn technology and technical skills while simultaneously addressing literacy needs.
The purpose of the new CTC grant program (CFDA: 84.341) is to create and expand community technology centers so they can provide technology training to disadvantaged residents of economically distressed urban and rural communities. The primary focus of the program is to use technology-related instruction to improve the academic achievement of students in secondary schools.

For FY 2004, Congress appropriated $10 million for the CTC program, under the technology component of the No Child Left Behind Act. Organizations such as foundations, museums, libraries, private non-profit organizations, and faith-based organizations that have the capacity to significantly expand access to computers and related services for disadvantaged residents of economically distressed communities are eligible to apply. The law requires applicants to provide at least $250,000 in matching funds. In-kind contributions, such as the value of property rental, are eligible to be considered matching funds. For more information, visit http://www.ed.gov/fund/landing.jhtml?src=rt.

CTCNet

Community Technology Centers' Network (CTCNet) envisions a society in which all people are equitably empowered by technology skills and usage. CTCNet is committed to achieving this end.

CTCNet shares with Playing To Win, its founding organization, a recognition that, in an increasingly technologically dominated society, people who are socially and/or economically disadvantaged will become further disadvantaged if they lack access to computers and computer-related technologies.

CTCNet brings together agencies and programs that provide opportunities whereby people of all ages who typically lack access to computers and related technologies can learn to use these technologies in an environment that encourages exploration and discovery and, through this experience, develop personal skills and self-confidence.

CTCNet offers resources to enhance each affiliated agency/program's capacity to provide technology access and education to its constituency and to help and nurture other like-minded programs in its area. CTCNet will facilitate telecommunications, print, and in-person linkages enabling members to benefit from shared experience and expertise.

CTCNet will be a leading advocate of equitable access to computers and related technologies; it will invite, initiate, and actively encourage partnerships and collaborations with other individuals and organizations

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64 The CTC program is authorized under section 5511 of Subpart 4 of Part D of Title V of the Elementary and Secondary Education Act of 1965 (20 USC 7263), as amended by the No Child Left Behind Act of 2001, see http://www.ed.gov/policy/elsec/leg/esea02/pg77.html.
that offer resources in support of its mission; and it will strive, in every arena, to bring about universal technological enfranchisement. (Source: http://www.ctcnet.org/about/index.htm)

**The Family Technology Resource Center (FTRC)**

The Family Technology Resource Center (FTRC) initiative is a simple, yet highly effective program to address the difficulties those without technology skills face in a booming digital economy. Family Technology Resource Centers are community-supported learning environments for all ages, educational levels, and economic status. The only requirement for participation is residence in the community in which the FTRC is located. There are no fees or tuition for participants. Participants give their time as unpaid volunteers back to their communities as a form of payment.

Research has shown that communities with Family Technology Resource Centers are generating high-achieving students, high-performance schools, and whole communities that embrace the value of learning. The center becomes part of a community with teachers, students, parents, businesses, and community groups working together to plan for center growth and expanded capacity to meet that community's immediate and future needs.

The benefits of the FTRCs are as follows:

- **FTRCs Leverage Existing Resources** — Community centers use existing school resources and infrastructure including hardware, courseware, networks, equipment maintenance, insurance, and related building amenities (utilities, furniture, security, telecommunications, and office equipment). They are normally housed in school buildings which have already been funded by the community. FTRCs are staffed with school personnel who typically work in the building that houses the Center. They are trained by the school district and managed by the FTRC executive director through local site coordinators.

- **FTRCs become multigenerational learning centers in the community** — Students stay after school to use courseware and software designed to improve academic achievement, communicate with global classmates, participate in activities via the Internet, and develop their own personal application skills. Parents/caregivers and other adult community members have access to educational technology and participate in instructional activities together (including basic literacy, GED completion, ESOL, and family-school-community activities).

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• FTRC involvement in the community is paramount — Technology is at the core of this program, and service to communities is the driving force. A community’s investment in the technology used with students during the day is amplified by additional usage for FTRC community participants.

• FTRC fosters adult education and literacy — Unable to gain a foothold in this emerging new economy are the millions of adults who lack basic skills, proficiency in English, or a high-school diploma or its equivalent. Literacy in the Labor Force (1999), an analysis of data collected as part of the 1992 National Adult Literacy Survey, found that adults with the lowest literacy skills were four-to-seven times more likely to be unemployed than those with the highest literacy skills. When individuals with the lowest literacy skills did obtain employment, they earned nearly a third less than adults with the highest literacy skills. The Literacy in the Labor Force report is available on the Website of the National Center for Education Statistics at: http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=1999470.

12.5 Public Information and Awareness

The research and best practice information in the following section supports recommendation CAP-5: Leveraging old and new media.

Successful implementation of an education technology plan requires buy-in and on-going support from school district and community stakeholders. To acquire community support, the school district should implement a comprehensive public information program that will raise awareness about school activities and needs, and keep the public informed about progress toward achieving the district’s strategic goals and implementation of the Information Technology Blueprint.

12.5.1 Print Publications

Print publications are essential for providing information to community members who do not have ready access to information technology or the Internet. Some departments within the school district are producing their own print publications, using software and technology they have or are accustomed to. There is not adherence to a style guide created by the communications officer.

Because the district consumes huge volumes of paper by using the print medium for communication, the district should consider posting newsletters online for the audience to read at their leisure. One newsletter targeting employees, as sources for information in their personal lives, would help to spread information within the greater community. Another newsletter might target parents, and a third could target businesses.
12.5.2 Web Communications Strategies

Web communications strategies using a fully implemented communication infrastructure can significantly enhance effective and positive internal and external communication. Web communication facilitates community outreach and raises public awareness about the district. Many print publications can be stored electronically and read online or printed on a home or office computer.

M-DCPS uses its website, http://www.dadeschools.net, to provide information about most of the district’s resources including:

- information for newcomers to the district
- school board contacts and schedules
- general overview of the district
- list of all district departments and links to their Web pages
- current district and school reports
- links to current job vacancies
- organizations and programs for community members
- links to the district media relations contacts
- school addresses, contacts, maps, School Improvement Plans, etc.
- district staff contact information
- district calendar with teacher workdays, vacation days, and early release days as well as both district and individual school meetings

By using Web communication, people from far and near can gather essential information about the M-DCPS without waiting for return phone calls or return mail.

12.5.3 e-News

Something that has been successfully done in Broward schools could be emulated in Miami-Dade County Public Schools. E-News is an electronic vehicle for communicating information and features about Broward County Public Schools. Anyone can receive e-News by going to the BCPS Website and following the link to sign up. Then e-News will be delivered directly to that person’s email inbox. Events and programs within the BCPS are communicated using this medium. There are stories such as Teacher of the Year and the Baby Book Buddies Program at Dillard Elementary that are told through e-News. Also e-News can be forwarded to a friend who might wish to read the information. To protect the privacy of e-News subscribers, BCPS will not sell, rent, or share names and addresses. Receipt of e-News is optional. A subscriber can also select the link at the bottom of the e-News email to unsubscribe or to receive less or more information.
Rather than emailing directly to parents or the community, M-DCPS posts critical new information on the front page of its website. Some parents complain that they do not want lots of email coming from school, but they do want to know what is going on. If an e-News feature is implemented, the creators should be sensitive to the size of messages and the option for users to receive in HTML or plaintext format (to reduce the size of the message).

The new School Improvement Zone website offers a common interface for all schools, with the content pulled from other sources. Two features are expected to be valuable: 1) the “Principal’s Message,” where a principal can quickly and easily update the website with a message that doesn’t require a programmer to post; and 2) Student Work, where an administrator can post a document, file or video clip of a student at peak performance. It is expected that this streamlined and always updated website will be something that other schools will also request.

12.5.4 TV and Radio

Both television and radio are traditional means of raising public awareness about school district activities and issues. M-DCPS uses the Internet through its Website to publish multimedia presentations similar to what appears on TV. Such multimedia presentations have the advantage of being available anytime to anyone with an Internet connection. As a public radio and television licensee, M-DCPS has WLRN radio and WLRN television that broadcast beyond the Miami-Dade county borders.

WLRN has 15 minutes of news in Haitian Creole each evening. Given the high penetration of radios in the Haitian community, the district might seek to have a low-power radio station in the midst of Little Haiti with additional information for parents who do not speak English. This would be a relatively low cost way to communicate information in a close-knit community. In contrast, there are a plethora of radio stations broadcasting in Spanish; school officials are often interviewed on them.

12.5.5 Public Awareness Campaigns

At various times a district needs to conduct public awareness campaigns through surveys and public forums. Technology is a useful tool for conducting surveys on the Internet, and can also be used to distribute material in preparation for public forums when education or district-related issues are discussed.

Web Surveying

- Pop-up Surveys: Pop-ups, which give a quick snapshot of user impressions and concerns, can be integrated into any Internet page. These surveys are typically no more than two questions.
Pop-ups are collected and analyzed expeditiously to support plans and implementation strategies. They can also be used as indicators of comprehension in instructional settings.

- E-mail and Web Surveys (Online): When surveys are delivered in e-mail or online formats, respondents decide when to take the survey, and how much time to take to complete a questionnaire. Surveys online can easily be delivered in a language of choice. The completion rate on paper-based surveys is typically less than 5%. Completion rates of Web and e-mail surveys can approach 70% or more, depending on the audience and survey relevance. There is real-time analysis of data, allowing for quicker reaction to a particular set of questions. Because there is no coding or keypunching necessary, there is also less room for systemic error.

Public Forums

Public forums are useful in bringing together two or more groups to have discussions that will increase understanding and develop cooperation. An example of a successful public forum conducted in Miami-Dade County during the past year is the School Board Forums that were conducted by the League of Women Voters and the Coral Gables Chamber of Commerce among candidates for the school board in August 2004. The Gables event was filmed and broadcast live on CGTV (cable channel 77 inside Coral Gables) and was also available on the internet; one voter reportedly watched while deployed in Iraq before casting an absentee ballot. Two years before that, CGTV also broadcast a meeting between the school system and the city over the plans for an addition at Coral Gables High School. This live broadcast meant that interested citizens did not have to leave home at night, and because it was rebroadcast, other citizens were able to learn the information when they saw the “rerun.”

Neither of these events had the opportunity for viewers “at home” to call in their questions, which could happen at another event with sufficient prior planning.

12.6 Community Involvement

School systems improve themselves by establishing constructive and collaborative relationships with parents, businesses, universities, and governmental, community-based, and cultural organizations. Forming such alliances has been important to M-DCPS, which is trying to increase the public trust. Community partners include the, the Parent Academy, the Dade County Council PTA-PTSA, and community volunteers. Business partners include Miami-Dade Partners in Education and other professional organizations.
Beyond school boundaries are area colleges and universities, libraries and community centers with which the district can form partnerships to offer programs and services for learning outside the schools.

12.6.1 Community Partners

County and Community Organizations

District Advisory Council (DAC): The DAC advocates and promotes the highest quality of public education by sustaining an effective network of parents, students, businesses, government agencies, schools, district staff and other community members. Its goals are to:

- maintain an effective network of school advisories by reaching out to achieve representative participation of all community members
- conduct ongoing assessments of legislative needs and promote awareness of the impact of legislative activities
- Dade County Council PTA-PTSA: Miami-Dade has a dynamic PTSA, which is affiliated with the state and national PTA. It is an important advocacy group for children's education issues. Many of Miami-Dade's schools have PTAs that work to support and advance school improvement at individual schools by organizing forums for discussion of concerns and issues, who help raise funds to buy technology, and who organize Family Technology Nights.

PTSA membership is open to all who believe in the National PTA Mission and Purpose. Parents, teachers, students and community members work together to support better education, more resources, and safer schools for every child in every neighborhood. PTA is committed to inclusiveness and seeks members of every culture, race, ethnicity, creed, economic, and educational status who are committed to the education, health, and welfare of children and youth. The website, [http://www.dadeschools.net/pta/](http://www.dadeschools.net/pta/), provides contact information, links to the PTSA calendar of events and activities, and other information about the Miami-Dade County Council of PTA-PTSA.

Some Miami-Dade schools have Parent Teacher Organizations (PTO) that operate independently to support limited parts of a school and their school improvement efforts. For example, Sunset Elementary has GIPA, FIPA and SIPA, which are the parent groups for students learning German, French or Spanish. Coral Gables High School has IBPO to help support the International Baccalaureate program at the school.
• Educational Excellence School Advisory Council (EESAC): School improvement is a priority for all Miami-Dade schools. To put plans into action, every school has an EESAC elected according to its bylaws, with parents, staff, and faculty represented. The EESAC receives $10/student from the state for items that will help student achievement, curriculum, safety, and discipline. These plans are on file at every school and are posted on each school’s Website. Parents/caregivers may call the local school to join the council as observers; parent representatives are generally elected at the first PTSA meeting in the fall.

• Community Volunteers: M-DCPS counts on volunteers in their schools to help teachers, to tutor students, to assist in the front office, and to act as youth motivators. The M-DCPS Community Involvement Department initiates and maintains community involvement that supports student achievement.

Career Days

Because the national Groundhog Job Shadow Day established by Colin Powell is so close to FCAT testing, another career exploration event is generally held later than Feb. 2. Students “shadow” a mentor in his/her workplace to discover how the skills learned in school can be used in the world of work, or more often, various career speakers come to schools to talk to students. This program can provide students with the “knowledge and skills they will need to achieve their dreams.” This is especially vital for the student who does not see the relevance of a sound education.

Professional Organizations and Associations

Within M-DCPS there are numerous professional organizations and associations. Any one of these organizations can be approached to form a partnership with the M-DCPS that would have an impact on school improvement. The Lions Club and Rotary often organize events to raise funds and support the schools. Other organizations like the Junior League can undertake projects and provide services to help involve the community in improving student achievement. Certainly the Boys and Girls Clubs build alliances with schools in order to offer programs that improve student learning. Most of the 22 Chambers of Commerce in Miami-Dade County have an education committee that is eager to help schools. Opportunities are endless for M-DCPS to engage professional associations and organizations in building a better school system.

12.6.2 Community Outreach

When schools reach out to adults in their community, everyone benefits. The adults gain access to school resources, and schools keep adults
informed about school programs and events. When the community has experiences with the schools through courses and activities, they are more apt to support their schools and programs. In return many community organizations and institutions offer programs that enrich people’s lives with lifelong learning activities. Lifelong Learning programs and County Library Learning Services are community resources that reach out to all ages with their services.

The Osher Lifelong Learning Institute

University of Miami has hosted The Osher Institute for Retired Professionals (IRP), now called the The Osher Lifelong Learning Institute since 1984 to provide educational and social programs for adults aged 50 and over, sponsored in part by the Office of the Provost. Founded in 1984, the Institute for Retired Professionals welcomes retired or semi-retired individuals interested in continuing education and the ongoing pursuit of knowledge. Sponsored by the University of Miami's School of Education, these programs provide an opportunity for individuals over the age of 50 to pursue educational and social programs in a relaxed setting within an university environment. Opportunities exist through the institute's classes as well as through auditing regular credit courses. http://www.education.miami.edu/irp/

Through the University, diverse life-enriching programs are offered in the social and natural sciences, humanities, arts, current affairs, and popular culture, resulting in the enhancement and personal growth of older learners.

The Institute for Retired Professionals (IRP) was recently named the recipient of an initial $100,000 grant from the Bernard Osher Foundation. Contingent on the IRP’s success and growth, the Bernard Osher Foundation will award two additional annual grants for $100,000. In the fourth year, the Institute will be eligible for an endowment of no less than $1 million. In recognition of the grant, the IRP will henceforth be known as the Osher Lifelong Learning Institute (OLLI) at the University of Miami. The grant will provide for the development of Learning Institute programs and activities. The IRP, sponsored in part by the Office of the Provost, was founded in 1984 to provide educational and social programs for adults aged 50 and over. Some examples of Life Enrichment Courses include:

- International Politics
- Great Cities
- Medical Potpourri
- The Examined Life with Dr. Thelma Altshuler
- Appreciation of Jazz, with Joe Donato
- The Old Testament
SeniorNet

SeniorNet is a non-profit organization of computer-using adults, age 50 and older. Its mission is to provide older adults education for and access to computer technologies to enhance their lives and enable them to share their knowledge and wisdom.

SeniorNet Learning Centers offer computer classes specifically designed for adults 50 and older. Since 1986 SeniorNet has educated over a million older adults about computers and the Internet to enrich their lives and enable them to share their wisdom. The SeniorNet Learning Centers offer a low-cost, friendly introduction to using computers. SeniorNet's basic curriculum is comprised of courses on introduction to computers, word processing, spreadsheets and going online and using the Internet. More advanced courses offered by the Learning Centers include topics such as genealogy, graphics, personal financial management and tax preparation with a computer. Most Centers offer open lab time where students can use computers to practice their skills or to work on individual projects. Some sites also offer participation in computer-user groups and specialty workshops and conferences on technology-related topics. Many Centers also provide social activities.

A typical center contains six to ten computers. Some Centers have as many as 15 to 20 computers. Almost all courses are step-by-step, "hands-on" courses with one, or at the most two, "students" at a computer. The Learning Centers are managed primarily by senior volunteers, and classes are taught and coached by volunteer instructors. Peer teaching is effective and rewarding for the older adult instructors as well as the students.
Learning Centers are housed in a variety of locations, including senior centers, community centers, public libraries, schools and colleges, and clinics and hospitals. Learning Centers are locally or regionally sponsored. Major sponsors include private foundations, Regional Bell Operating Companies, computer companies, health care providers and financial services companies.

SeniorNet works with local agencies and sponsors to establish new Centers. The organization has benefited millions of seniors since its foundation in 1986 through funding from the Markle Foundation. It supports over 240 Learning Centers worldwide, publishes a quarterly newsletter and a variety of instructional materials, offers discounts on computer-related and other products and services, holds regional conferences, and collaborates in research on older adults and technology. Today SeniorNet is supported by membership dues, Learning Center fees, the altruistic donations of individuals and the generous sponsorship of many companies and foundations.

All individuals 50 and older, whether or not they are members of SeniorNet, can participate in online communities and hundreds of discussion topics offered on these sites. SeniorNet members learn and teach others to use computers and communications technologies to accomplish a variety of tasks. They learn to touch up photos, and send and receive them in email, publish anything from a newsletter to an autobiography, manage personal and financial records, communicate with others across the world, and serve their communities.

Nova Southeastern University works with SeniorNet to offer computer classes at two locations:

- North Miami Beach classes are held in Room 167 of the Administration Building, 1745 NE 167 St., North Miami Beach, 33162.

- Davie classes are held on the Nova Southeastern University campus, in the Parker Building at 3301 College Ave, Davie, 33314.

Most courses meet for seven weeks, one day per week, in two-hour sessions. The typical sequence is "Getting Started" for seven weeks; then "Windows" for seven weeks; followed by any other courses offered; these may be taken in any order.

The courses are offered Monday through Friday, normally beginning either at 9:30 a.m. or 1:30 p.m. from October through May each year.

Higher Education

Miami-Dade County has several excellent universities. They include Florida International University, the University of Miami, Barry University,
St. Thomas University, Florida Memorial University and Carlos Albizu University. In addition, the largest institution of higher education in the country is Miami-Dade College, with six campuses and more than 160,000 students. These institutions offer programs that extend learning beyond the walls of the M-DCPS. Dual enrollment programs allow good students the opportunity for academic challenges and earning college credits while in high school. M-DCPS has two high schools, called School for Advanced Studies, located at MDC North and MDC South. Students take half of their classes from high school teachers and half from college professors. Most of these institutions are offering at least some courses online.

Public Libraries

Miami-Dade County Public Libraries serve the needs of individuals and families by creating, promoting, and implementing environments and tools which support the lifelong learning goals of its patrons, including access to print and database materials as well as access to the Internet. A critical program offered through Learning Services is the Literacy Program which was added in 1980 once the staff discovered that many of its patrons could not read.

The Miami-Dade Public Library System offers Internet access at computer stations in all 35 branch libraries. Through the Internet, library patrons of all ages and walks of life can make use of the broad array of Web-based resources to support their lifelong learning. Internet stations in the children’s section of the library have adults nearby to assist with searching.

Miami-Dade County’s Public Library System, like all other major libraries, provides convenient access to a full range of innovative and cost-effective services that satisfy the changing needs of the people of Miami-Dade County for information, education and recreation. The resources of this comprehensive library system are described below. Several of the resources are available through the Internet, making it possible for the schools to enlarge and enrich its educational resources.

Miami-Dade County Libraries Division consists of a flagship Main Library facility, four regional libraries, 30 branch libraries, three reading centers, a DigitalBranch, four bookmobiles and computer information kiosks at two shopping malls.

The Library has a combined catalogue of millions of books, videos, cassettes, CDs, DVDs and subscription databases. The online catalogue is available in English and Spanish through the World Wide Web, and provides access to all library materials, an electronic encyclopedia, magazines and newspaper indexes, databases on business, literature, education and health and access to the Internet. The KidsWeb online
catalogue is colorful and user-friendly with over 5,000 pre-selected Web links for children.

Special services include a Computer Lab with courses such as introduction to Windows, the Internet and other beginning level classes, in English and Spanish: course schedule. Classes are so popular that they are filled ten weeks in advance. The Miami-Dade Public Library System offers free beginner’s level computer training programs for the community at computer labs at:

North Dade Regional Library
2455 NW 183 Street
305-625-6424

South Dade Regional Library
10750 SW 211 Street
305-233-8140

These are two locations where sessions for parents in using the electronic gradebook could be offered, if library personnel were willing. Or public library personnel could be invited in to community school media centers to conduct classes at those 22 sites.

Other services include:

- Bookmobile Services operates two mobile library vehicles to bring the full range of library services, books and materials to more than 30 locations weekly.

- Services for People with Disabilities are the special programs and assistive devices the library offers to help make it possible for a person with a disability to access materials, equipment and services. Assistive Technology refers to the special services and assistive devices the library offers to help make it possible for a person with a visual, hearing or speech impairment to access materials, equipment and services.

- Connections: Library Service for the Homebound provides books-by-mail service to individuals of all ages unable to visit the library in person due to chronic illness, physical disability and frailties of age. Special outreach programming services to facilities and groups who serve the elderly are also available.

- Talking Books Library loans books and magazines on cassette tapes or in Braille FREE by mail to persons who have difficulty seeing or using standard small print.

- Literacy Programs are those programs and services the library offers to its patrons of all ages who want to pursue the ability to read and write. Literacy skills are enhanced with the availability of reading materials appropriate for beginning readers, whether they are children or adult new learners.
• Jump Start is the Miami-Dade Public Library System’s preschool story kit program for licensed childcare centers. Jump Start kits contain all the tools needed to present fun, high quality story times on a variety of topics. Each kit includes books, fingerplays, a flannel board story, songs, and a musical cassette.

• Project L.E.A.D. (Literacy for Every Adult in Dade) is the library’s adult literacy program, which offers free, one-on-one, confidential tutoring to improve reading and writing skills. Adult learners are matched with volunteer tutors who help them achieve self-determined literacy goals.

• S.M.A.R.T. stands for Science, Math, and Reading Tutoring and is the library’s response to overwhelming requests from both parents and children for homework assistance.

12.6.3 County-wide Summit on Technology, Learning, and Economic Development

A county-wide summit on technology, learning, and economic development will explore linkages for a citywide integrated information and technology system in support of learning and economic development to enhance the connectivity among home, school, and community. (See Figure 3.1)

![Figure 12-1: An Integrated Technology System in Support of Learning and Economic Development](image-url)
The summit will:

- showcase strategies for increasing student achievement using technology
- explore the interrelationship between technology, schools, and the economic growth and development of Miami-Dade County/Tri-County
- build and sustain support for the school district’s technology initiatives
- identify current and emerging employment needs of local business and industry
- establish community partnerships among schools, businesses, and government agencies
- identify the basic proficiencies of a 21st century knowledge worker
- identify contemporary career exploration opportunities for students of all ability levels
- assist schools in transcending from an educational institute to a community-wide learning organization

This summit will bring together all people who have an interest and stake in being informed as to how technology is used in schools. Keynote speakers and featured presenters will be captains of industry, business, technology, and politics. Other sessions include:

- panel discussions among diverse community-wide representatives
- special interest sessions based upon specific audiences within the community, such as pre-school parents, local small business owners, and senior citizens
- exhibit and demonstration area including students, vendors, local business/industry projects and community resources
- invitational dinner with guest speaker
- recognition of M-DCPS classroom teachers who have demonstrated exemplary use of technology to improve student learning
- dissemination of curriculum/technology integration best practices
- sharing of technology programs and resources among community organizations

Panels and presentations will include topics such as:

- Online Courses For Personal and Professional Growth
- Technology and its Impact on Economic Development
- Technology Proficiencies for the World Of Work
- Community-Wide Information Utility System
- Technology in Our Schools: Current Innovative Practices and Emerging Technologies
- New Basic Skills for the 21st Century Learner
- Technology Skills for the Entrepreneur
- Internet and Electronic Communications

The county-wide summit on technology, learning, and economic development will inform attendees how technology in schools: a) can improve learning; b) prepare students for the 21st century world of work; and, c) is critical to the economic development of the community. This event will engender positive recognition for MCCPS and showcase the district as a leader in harnessing the power of technology to increase student achievement and create life-long learners.
13.0 MONITORING AND EVALUATION

Included in the Technology Blueprint are a number of Major Recommendations. The purpose of this section is to provide a summary of the research and best practices information available to support the recommendations. The major recommendations related to Monitoring and Evaluation are:

- M&E-1: Adopt Monitoring and Evaluation Processes, Structures, and Tools
- M&E-2: Disseminate Data Analysis Results
- M&E-3: Establish Priorities for Program Evaluation Director

In support of these recommendations, the following information presents current research and best practices for the topics covered in Chapter XIII—Monitoring and Evaluation. To facilitate navigation of the information in this section, the following is a table of contents for this section:

- Planning and Monitoring
  - Monitoring Purpose and Strategies
  - Key Tasks for Monitoring the Technology Blueprint Implementation
  - Using the Balanced Scorecard, Digital Dashboard, and other Technology to Track Progress
- Plan Evaluation
  - Steps in the Evaluation Process
  - Evaluating Technology Plan Outcomes
- Reporting Outcomes to Stakeholders
  - Reporting Procedures
  - Communication Processes

The purpose of planning, monitoring, and evaluation is to address the question of how well the district is implementing the essential tasks and activities related to each strategic technology initiative. The topics included in this section are:

- Planning and Monitoring
- Plan Evaluation
- Reporting Outcomes to Stakeholders

In addition to nationally researched approaches, the current work of the M-DCPS and the state of Florida is reflected in this body of knowledge.
13.1 Planning and Monitoring

Planning and monitoring enables the district to track the attainment of implementation milestones and benchmarks, such as purchasing and installing systems (hardware and software), conducting training, implementing programs, and/or hiring/repositioning staff.

13.1.1 Monitoring Purpose and Strategies

The research and best practice information in the following section supports recommendation M&E-1: Adopt Monitoring and Evaluation Processes, Structures, and Tools.

Typically, implementation monitoring is focused on the execution of plan initiatives. Implementation monitoring will provide real-time information and requires systems for watching and adjusting in a real-time mode to maintain compliance with the plan and to guide decisions regarding adjustments. Managers of technology initiatives need to track important data and communicate that data effectively to a variety of stakeholders.

Implementation monitoring strategies address questions such as:

- Were tasks completed as designed? Were implementation timelines met? Were expenditure levels and patterns as expected? If not, why?
- What barriers were encountered during implementation? How were they addressed?
- What adjustments were made in key tasks and activities? Why? To what effect?
- What are the implications of these mid-course corrections for improving or redesigning the plan?
- What were unexpected outcomes, either positive or negative, that should be noted for future implementations?

The planners carefully select tasks and activities and are interested in determining the fidelity of the implementation of these tasks and activities at each site in the district.
13.1.2 Key Tasks for Monitoring the Technology Blueprint Implementation

Key SMS tasks related to monitoring plan implementation include:

- **Identification of Tasks, Deliverables, and Timelines**: Each major initiative or program should include a delineation of tasks and timelines.

- **Discrepancy Analysis**: Each project manager should undertake a discrepancy analysis of expected versus actual implementation performance.

- **Information Systems**: The use of project management software would allow the district to employ continuous feedback systems to monitor time lines, key events, and measures of cost and productivity. Such software, and related databases, can document, capture, and make information widely accessible on the myriad of small, immediate adjustments occurring during implementation.

- **Communication**: Processes, structures, and tools need to be established for uniform communication, regarding adherence to timelines and related deliverable specifications.

- **Decision-making Structures**: Processes and structures need to be established for informing decisions about mid-course corrections and possible redesign of project/program initiatives. All monitoring information should be maintained in a database, accessible by key decision makers during the monitoring cycle.

13.1.3 Using the Balanced Scorecard, Digital Dashboard, and other Technology to Track Progress

Drs. Robert Kaplan (Harvard Business School) and David Norton developed a novel approach to strategic management in the early 1990s. This system is named the “balanced scorecard.” Recognizing some of the weaknesses and vagueness of previous management approaches, the balanced scorecard approach provides a clear prescription as to what companies should measure in order to “balance” their financial perspective.

The balanced scorecard is a **management system** (not only a measurement system) that enables organizations to clarify their vision and strategy and translate them into action. It provides feedback around both the internal business processes and external outcomes in order to continuously improve strategic performance and results. When fully deployed, the balanced scorecard transforms strategic planning from an academic exercise into the nerve center of an enterprise.
Technology can help pull together project data into a meaningful structure for progress tracking. Many organizations use dashboards (see Figure 2-2) of selected performance information customized for each specific initiative or objective. These dashboards are updated regularly and made available to the managers of specific initiatives.

![Sample Performance Information Dashboard](image)

**Figure 13-1. Sample Performance Information Dashboard**

Figure 13-1 is a generic skeleton of a dashboard prototype, with graphical components that are useful in the quick assessment and evaluation of project status for management review. The selection and usage of statistical graphs is determined by the type and breadth of the data, the audience it is directed to, and the questions being asked.

The types of data captured in a typical dashboard include both qualitative data (e.g., words or text) and quantitative data (numbers). For outcomes that can be tracked or measured against a quantifiable benchmark, the identical odometer-like indicators in the top left-hand corner of the dashboard, along with the three thermometer-like indicators below them, are useful for relaying measured progress. These indicators are useful for displaying budgetary information (actual versus estimated, percent expensed, balances) and duration (% complete, % towards goal, remaining duration).

The histogram in the top right-hand corner of the dashboard displays continuous data in ordered columns as compared to a normal curve. A histogram is visually strong and categories of continuous measure include time, cost, etc. Another visually appealing indicator is the pie chart in the bottom right-hand corner of the dashboard, which is useful for displaying data as a percentage of the whole. The pie chart’s utility also comes into play if there is a need for displaying the distribution of resources among different departments.
The thermometer at the bottom could indicate overall project status, giving an overall indication of the project's performance, based on the objective indicators and subjective project managers' opinions. Much can be inferred through these visual indicators, which is why they are so useful for the above-the-trees view of the forest when it comes time to monitoring and evaluating troubled projects.

Table 13-1 below illustrates ways the district might design an implementation monitoring for a specific technology objective.

### Table 13-1. Indicators for Sample Technology Objective 1.1

**Objective 1.1:** Connect all classrooms to the network and provide classroom technology to meet the current district standard.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Data Sources</th>
<th>Measures</th>
<th>Data Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td># / % of classrooms, by school, connected to the Internet</td>
<td>School technology coordinator</td>
<td>School technology inventory</td>
<td>District provides online tools for ongoing data collection</td>
</tr>
<tr>
<td># / % of technology-rich classrooms, by school</td>
<td>School technology coordinator</td>
<td>checklist of district standards for technology-rich classroom</td>
<td>District provides online tools for ongoing data collection</td>
</tr>
</tbody>
</table>

**13.2 Plan Evaluation**

While implementation monitoring is important, the district needs to give emphasis to evaluating the impact of the *Information Technology Blueprint*, particularly as the plan increases its emphasis on technology integration into teaching and learning and administration and management. The purpose of the evaluation component of a comprehensive SMS is to provide ongoing information on outcomes.

The outcomes evaluation addresses these questions:

1. How well is the district accomplishing the specific objectives related to each technology initiative?
2. How well is the district accomplishing the specific student technology learning outcomes?
3. How well are the strategic technology initiatives contributing to the success of the district’s strategic plan?
Addressing these questions can be accomplished through both formative and summative evaluation. Formative evaluation obtains performance data to inform ongoing refining and redesign, while summative evaluation obtains performance data to inform overall judgments regarding the effectiveness of specific technology initiatives.

13.2.1 Steps in the Evaluation Process

The district should take these action steps to develop the evaluation components of the SMS:

Step 1: Identify indicators, benchmarks, and measures for each objective.

Indicators are statements that orient the system to a measure of performance that can be used to gauge progress. Each indicator typically focuses on only one aspect of an objective. Related to each indicator will be benchmarks and measures. A benchmark is a specific target that describes an expected level of success. Measures must also be determined. A measure is an item reflecting the evidence needed to answer a research question, inform an indicator, or determine how close the organization is in achieving a benchmark. A measure typically includes data such as percentage, test scores, ratios, etc. They are similar to indicators but are much more specific and concrete.

Indicators are statements that orient the system to a measure of performance that can be used to gauge progress. Each indicator typically focuses on only one aspect of an objective. In addressing each of these five capacities of districts, the district may use a combination of five types of indicators:

- **Outcomes:** Measures of outcomes that include student learning, equity of access to technology, and quantity and quality of technology-rich student learning opportunities provided by teachers.

- **Output:** Measures of products and services provided, such as the number of teachers trained, number of curriculum guides with technology skills embedded, and number of classrooms connected to school and district telecommunication networks.

- **Input:** Measures of resource allocation and use that encompass the ratio of students to computers; resources allocated to education, training, and support activities; and allocation of technology resources across schools.

- **Productivity:** Measures of work performance, such as time to install school networks, hours of training required to produce teachers competent in using technology in their classrooms, and average time to respond to requests for technical assistance.
• Demand: Measures of potential markets that include the number of requests for pedagogical and technical assistance, number of teachers needing specific types of training, and number of classrooms with obsolete equipment.

Each of these five types of indicators can be used to describe conditions or performances at district and school levels. Depending upon the level, one unit’s input can be another unit’s output or impact. For example, the number and percent of teachers using technical support services may be a demand indicator for schools and an also an impact indicator for the educational technology staff or those responsible for providing training and support services.

**Step 3: Assign responsibility for evaluating each objective to the appropriate program manager**

Evaluation should be embedded within the appropriate program unit responsible for each objective. The assessment process should be simultaneously top-down and bottom-up, gathering information from the operating system about what is happening in schools with respect to the objectives, what new or enhanced interventions are needed to obtain the results, and what new or unanticipated outcomes and results are being realized. Program managers need to understand and take responsibility for their own strategy map.

**Step 4: Select measures and methods**

Data gathering will require the use of uniform measures and methods for each indicator. Standards should be established for assuring quality data collection and analysis. Qualitative as well as quantitative data are needed. Each program manager must use methods such as focus groups, on-site observations, and participant journals to obtain an in-depth picture of what is happening.

**Step 5: Establish a database for tracking performance measures**

Such databases can be linked to Web-based tools for data entry and analysis. The district should employ databases, preferably electronic, for collecting, organizing, and disseminating data and information in diverse forms to serve multiple audiences. For example, the system could provide guidance in developing databases of best practices in several categories—teaching and learning, communications, administration, and management. These databases could address what is working and why, and what is not working and why. Databases could also be used to set up discussions on various instructional and administrative strategies;
even chat rooms among teachers and principals are very useful. The intent is to make information available to all using the district’s telecommunications infrastructure as well as more traditional means of communication.

**Step 6: Develop analysis and reporting procedures and formats**

Detailed analytic reports and simple Web-based displays linked to key objectives and indicators should be used. The district evaluation team helps decision makers develop and use a suite of e-tools for collecting, analyzing, and reporting data on selected performance indicators.

**Step 7: Identify key decision makers requiring specific indicator data**

District decision makers must be targeted regarding their information needs and decision-making contexts. This process should be linked to the Plan-Do-Study-Act cycle. Each strategic technology initiative manager is responsible for reporting on a select number of indicators (4-6) that communicate progress in addressing specific technology objectives. Dashboards are created for each initiative and for the overall Information Technology Blueprint.

**Step 9: Provide training and support**

The district must provide technical assistance to decision-makers in such areas as data collection, data management, data analysis, and communication. The technology of monitoring and evaluation must be complemented by competencies. There must be an organizational capacity to learn and adjust. Database decision-making must become a core competency. One way to provide this assistance may be through contracts with researchers at area universities, who have in depth knowledge of the most current data collection and analysis techniques.

**Step 10: Support school- and district-based action research**

A growing body of research identifies the characteristics of learning opportunities and environments that affect student learning positively. The district could support schools in their use of action research to identify those specific characteristics and attributes. Some action research initiatives already exist in partnership with local universities and nonprofit groups and these partnerships could be expanded.
Step 11: Use technology applications to support evaluation

The district might develop electronic databases and scorecards to alert and inform automatically those who need to know about specific data, as in the case of a principal tracking a new program’s performance or a teacher watching her students’ progress on a key learning standard. The district could use Web-accessible databases to capture, organize, and make widely available information on numerous small, immediate adjustments made during implementation. These systems can provide up-to-date information on the status of each indicator.

Effectively implementing these strategies will require talents and resources beyond those currently available in the district. Developing monitoring and evaluation as a core competence is so important, however, that the district may want to develop partnerships with local higher education institutions and other organizations that have expertise in these specific functions. In addition, institutions of higher education offering advanced degrees in technology, research and evaluation, or leadership may view the district’s technology initiatives as targets of opportunity for graduate research.

13.2.2 Evaluating Technology Plan Outcomes

Key SMS features for evaluating the outcomes of the technology plan include:

- Focus on results: Decision-makers emphasize assessment of results stated as performance outcomes. They establish processes for engaging stakeholders in identifying what constitutes success.
- Embedded assessment: Emphasis is given to self-assessment and to enhancing the capacity of program managers to evaluate their educational technology initiatives.
- Decision-making as inquiry: Real-time information is linked to the decision-making structure. Evaluation is not treated as an event but an inquiry process embedded in the educational technology planning process.

Selecting appropriate variables and tracking relevant indicators pose serious challenges. While there is considerable pressure to judge the effectiveness of technology using student performance data, there is a concern with using one measure to judge effectiveness, particularly student performance as assessed by current measures. The SMS must use multiple indicators and measures in order to enhance the validity and reliability of such judgments.

The district will consider using more holistic, qualitative data in the form of rich descriptions of what is happening in classrooms with respect to technology-embedded learning opportunities. In many cases,
technology's real impact may be in areas that are not under the analytic spotlight. It will take a systemic approach to illuminate the issues and their interconnectedness. A system that collects rich/thick description may be more appropriate and is a task that teachers and principals may be able to perform most effectively. The challenge is to create simple systems for teachers to enable them to collect useful data on instructional practices that serve as measures of high learning performance.

With such a system in place, the district will be more precise in addressing questions about the broad impact of education technology investments as well as on more specific questions regarding specific outcomes. The district seeks rich description as well as quantitative data on a diverse set of variables, most often focused where the real impact may be on the nature of the learning process itself.

Table 13-2 illustrates ways the district might design an outcome-focused evaluation for a specific technology objective.

Table 13-2. Indicators for Technology Objective 2.1

Objective 2.1: Develop and deliver standards-based staff development.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Data Sources</th>
<th>Measures</th>
<th>Data Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td># / % of teachers, by school, implementing selected technology-supported instructional practices integrating Internet resources</td>
<td>Teachers completing staff development</td>
<td>Teacher self-assessment checklist; teacher demonstration by preparation of artifact</td>
<td>District provides online tools for ongoing data collection</td>
</tr>
</tbody>
</table>

13.3 Reporting Program Outcomes to Stakeholders

Successful technology program evaluation is dependent upon continuous consideration of the way the study output will support decision-making in M-DCPS. Likewise, the success of any project is linked to the success in communicating effectively its intent, processes, implementation phases and approaches, and outcomes to all stakeholders.

13.3.1 Reporting Procedures

The research and best practice information in the following section supports recommendation M&E-2: Disseminate Data Analysis Results.
The results of an evaluation provide evidence for informed decision making. However, collecting evaluation information has limited utility unless we can communicate it effectively to decision makers and stakeholders so that they can act on the knowledge. In order to maximize the impact of evaluation results:

- The presentation of results is tailored to meet the needs of the intended audience.
- The evaluation data is made available to appropriate stakeholders and delivered to meet decision-making timetables.
- Evaluation studies are designed and conducted to meet the critical interests of stakeholders.
- Strategies for both the dissemination and utilization of key findings are specified during the planning stage of the evaluation.
- Studies of the degree to which the results are utilized become input to future planning efforts.

13.3.2 Communication Processes

The dissemination of evaluation data to all those who need to know can be quite challenging. For internal communication, a different approach is proposed that redefines the task as one of accountability rather than dissemination; that is, the district could assign data collection on benchmarks and indicators to those units or staff accountable for accomplishing the objectives related to those indicators. When specific staff members are accountable for certain outcomes, they will have a built-in self-interest in the scope and quality of the data they require. If this alignment of need and use is not established, communication becomes a problem of dissemination—convincing various people to access and analyze data they are not convinced they need.

When considering communication processes for external audiences, such as parents, community members, and agencies outside M-DCPS, it is important to recognize that long reports are not the only way to communicate results. PowerPoint presentations, informational meetings, cable television broadcast, and Web pages are but a few alternative possibilities. Likewise, information regarding evaluation data must be presented in formats, languages, and methods that align with the intended audience. Successful dissemination of evaluation data and communication with the broad Miami-Dade community is an on-going process that continually requires the 1) identification of specific audience(s), 2) selection of intended message(s), and 3) determination of dissemination strategy.
14.0 BUDGET, FUNDING SOURCES, AND TOTAL COST OF OWNERSHIP (TCO)

Included in the Technology Blueprint are a number of Major Recommendations. The purpose of this section is to provide a summary of the research and best practices information available to support the recommendations. The major recommendations related to Monitoring and Evaluation are:

- **BFT-1**: Acquire Information Technology Resources and Services Using an Enterprise Wide Solution
- **BFT-2**: Establish a District Technology Refresh Policy and Fund It Centrally
- **BFT-3**: Make Total Technology Spending Visible to Each Organizational Unit
- **BFT-4**: Ensure that All Technology Projects Eligible for Capital Funding Are Included in the Five-Year Capital Plan
- **BFT-5**: Re-invest E-rate Dollars Back Into the District’s Technology Program
- **BFT-6**: Expand Focus of District E-Rate Group

In support of these recommendations, the following information presents current research and best practices for the topics covered in Chapter XIII—Monitoring and Evaluation. To facilitate navigation of the information in this section, the following is a table of contents for this section:

- Total Cost of Ownership
- Budgeting for technology
- Operating and capital funds
- E-rate and other sources of funding

This section addresses best practices utilizing current research in the following major topic areas:

- Total Cost of Ownership
- Budgeting for technology
- Operating and capital funds
- E-rate and other sources of funding

In addition to nationally researched approaches, the current work of the M-DCPS and the state of Florida are reflected in this body of knowledge.
### 14.1 Total Cost of Ownership

The research and best practice information in the following section supports recommendation BFT-1: Acquire Information Technology Resources and Services Using an Enterprise Wide Solution.

Computing and network systems Total Cost of Ownership (TCO) is defined as the cost for delivery of a specific functionality for a specified period of time that includes all the elemental and incremental costs. TCO is a total view of costs across all the involved organizations and, as such, provides a complete view of a project or an asset's costs. It comprises a set of tools and methodologies to measure and manage the costs.

COSN/Gartner Group\(^{66}\) has benchmark data on eight U.S. school districts that have used TCO. The results show that the total cost of ownership data painted a picture that was entirely different from the traditional justification of individual projects. Many districts found in their original implementation of TCO that some cost data was difficult to obtain because of the inadequacies of the financial system. The case studies show how TCO led the schools to target specific areas that were candidates for cost reduction.

Best practices in developing a cost model for K12 schools that assesses costs over a 3-5 year period include:

- **design:** engineering, piloting, testing, evaluation
- **acquisition:** procurement, direct costs of purchased and leased hardware, software and services, receiving/inventorying, installation, facilities, startup, configuration
- **operation:** administration, scheduling, monitoring, tuning, back-up, maintenance, repair, change management
- **support:** technical, functional, training, troubleshooting
- **usability:** efficiency of access, simplicity of use, increased capabilities
- **productivity:** lost availability, information recovery
- **hidden:** off-purpose use, co-worker support, unaccounted facility expenses

The COSN/Gartner Group study found that the use of TCO helped the districts:

- Manage and assess technology investments in the context of organizational goals
- Measure the impact of technology;

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- Develop and document budgetary guidelines
- Understand the actual costs for new initiatives
- Identify and document ongoing direct costs and indirect labor costs for technology services.

AEL’s Institute for the Advancement of Emerging Technologies in Education (IAETE) has recently updated its online TCO calculator to assist schools in developing school and district technology budgets. As with any budget/cost model, the TCO analysis begins with a detailed list of assumptions. It is necessary to clearly define the way these assumptions influence the factors for each category of cost and ask whether the assumptions contribute costs to the various options under analysis. Typical assumptions include number of users; demand or use of systems; nature of demand and changes in demand; or utilization over time.

The IAETE K12 TCO Calculator divides costs into three broad elements: acquisition costs, external services, and internal services, although it generally follows the COSN TCO model. Acquisition costs are generally the most easily quantified including hardware, software, and other line-item entries. External services are defined as external activities delivered to the district. Internal services include personnel costs and internal direct and indirect expenses for personnel, facilities, other resources and charges.

Acquisition costs are the easiest to quantify while support costs are generally the largest over the life of the system. Usability is difficult to quantify; unless there is a defined way to put numbers against functionality, it is best to either leave the numbers out or clearly cite the supporting evidence. Productivity costs include loss of staff productivity during downtime, lost-opportunity cost due to lack of availability, and information recovery. Hidden costs can be a substantial value but difficult to ascertain.

# 14.2 Budgeting for Technology

The research and best practice information in the following section supports recommendation BFT-2: Establish a District Technology Refresh Policy and Fund It Centrally and BFT-3: Make Total Technology Spending Visible to Each Organizational Unit.

Since cost is not the driving force it is in private businesses, it is difficult to show the return on investment (ROI) on many IT projects, let alone on the total organizational spending on technology.

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67 “K12 TCO Calculator”, AEL’s Institute for the Advancement of Emerging Technologies in Education (IAETE), http://www.iaete.org/tcov2/
69 “Charge back for good or evil”, Wheatley, M., CIO Magazine March 2003
In some industries, IT is managed as a percentage of the total budget of the enterprise. Considerable time is spent on benchmarking similar companies within an industry to determine what this percentage might be. Any unusual expense in a given year requires a rationale and approval for the proposed expenditure above the benchmarked percentage. Industry associations are used in some cases to obtain the data. They represent an independent third party and spend much time on helping to get these percentages right from the member companies. It is a laborious process to define the categories and to insure there is an apple to apples comparison. It is not clear what this percentage might be for K-12 public schools.

Another best practice in many private businesses is to charge back IT services. This turns the IT organization to a business within a business and results in IT developing a customer service orientation. It changes the IT organization from an efficient one to an effective one. Charge back can be very detailed and time consuming by itself. Adult/Vocational and Community Schools may provide and avenue to provide these services.

Best practices simplify charge back so it is well understood to the point a organizational unit head can take action on it. A further best practice is to charge IT services only to the major organizational units and not to all the individual departments within the organizational unit. Further it would be charged back in three basic areas:

- **Data center services** – this would include hardware, software, support staff, floor space, utilities consumed, print costs, and any contracted services. These costs are billed to major organizational units based on the hours of run time consumed. The data center will calculate a TCO cost per computer hour, then extend this by the number of hours used by each application. Also the Data center would accept a responsibility to drive this cost per hour down over time to show productivity gains.

- **Infrastructure** – This would include the help desk, WAN, LAN, installation and repair services for phones, desktops and other networked devices, any contracted services, hardware, and software costs. This total budget would be divided by the number of desktops in the district to get a cost per desktop. The bill to each organizational unit head would be the cost per desktop times the number of desktops in his/her organization. It is an easy calculation that for every person added to an organization there is an added cost of a fixed dollar amount per desktop per year. Also the IT organization would accept a responsibility to drive this cost per desktop per year down each year to show productivity gains.

- **Applications** – This would be a contracted service of a fixed amount of dollars for each application regardless whether it was developed in house or bought from the outside. In addition to the cost and maintenance of the application, in a similar manner the support costs for each application would be charged to each organizational unit.
The total annual bill for IT services would be the sum of each of these three areas for each organizational unit head. Again, do not try to get too detailed, keep the charge back to the organizational unit only.

In some cases the part of the IT budget that the organizational unit is responsible for is transferred to each organizational unit. The IT organization’s budget becomes zero with this charge back methodology. It makes the organizational unit head responsible and accountable for the IT services he/she consumes. In this way, the organizational unit head makes the investment decisions on whether to and how much to invest in technology in support of his/her organizational unit.

14.3 Operating and Capital Funds

The research and best practice information in the following section supports recommendation BFT-4: Ensure that All Technology Projects Eligible for Capital Funding Are Included in the Five-Year Capital Plan.

The vast majority of a District’s budget is classified as operating funds and capital funds. The operating funds are intended to pay for current operations during the district fiscal year, typically July 1 of one year through June 30 of the following year. Capital funds are intended to pay for improvements and equipment with a relatively long life, typically seven or more years in most states.

Even though a computer workstation is expected to be useful for three to five years, most states require them to be purchased out of operating funds. Software for use on computer workstations is also paid for out of operating funds. With respect to technology infrastructure, capital funds are typically used to install wired or wireless networks, switches and servers because these devices have a life of seven years or more.

The purchase of software is generally not eligible for capital funds, not because it does not have a long life but because it is intangible. In the early days of software, only the computer equipment the software ran on was considered eligible for capital funding since it was considered a tangible asset. Later, the financial markets and most states changed the rules to allow the purchase of software if it was an essential part of a “computer system.” Originally, software was a small percentage of the cost of a computer system. Today, hardware is often a small percentage of the cost of a computer system, which has caused some states to question this approach again.

Although each state generally follows the above guidelines, there are major inconsistencies among states with respect to what is considered a capital purchase. Districts, of course, must follow the rules of the state they are in.
Where it is consistent with state rules, purchases of long-lived technology, including major applications (financial, human resource, student, transportation, library, assessment, etc.) as part of a computer system, should be purchased through capital funds. This allows the cost of such systems to be spread out over time to match their expected life.

14.4 E-rate and Other Sources of Funding

The research and best practice information in the following section supports recommendation BFT-5: Re-invest E-rate Dollars Back Into the District’s Technology Program.

The Telecommunications Act of 1996 established special discounts of 20-90% for schools and libraries under the Universal Service program, popularly known as the E-rate. The discount levels are based on the level of poverty as measured by the percentage of students eligible for the National School Lunch Program (NSLP). Only purchase of eligible telecommunications, internet access, and internal connections (network infrastructure) services and equipment are eligible to receive the discounts. Most districts use savings from the E-rate program to fund technology equipment, software, and training that are not eligible for E-rate reimbursement.

The E-rate program has authorized over $90 million in telecommunications and infrastructure discounts to M-DCPS since the program’s inception. By continuing to apply for E-rate funds, the district will continue to maximize its dollars to enhance interconnectivity and access to the Internet. The district’s E-rate planning team helps ensure that M-DCPS continues to maximize the funding that it receives from the program by:

- coordinate procurements, contracts and implementation schedules, including wiring, to maximize eligibility
- apply yearly for the installation and cost of eligible technology items and also for maintenance of previously installed equipment and ongoing Internet, telephone, and data network services
- establish implementation priorities based on highest E-rate discount levels of the schools to minimize lost funds if E-rate projects cannot be completed during the funding cycle
- work directly with the schools to explore new opportunities for funding and expansion of the program

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70 Universal Service Administrative Company, Schools and Libraries Division, http://www.sl.universalservice.org
Program Overview and Priorities

School districts use the NSLP percentage for each individual school to calculate each school’s E-rate discount. They then calculate a district average using a weighted average of all schools.

Since the E-rate program has a limited amount of funds, it divides all eligible equipment and services into two categories known as Priority 1 and Priority 2. All approved Priority 1 requests are funded first. If any funds remain, approved Priority 2 requests are funded beginning with neediest applicants (90%, 89%, 88%, etc.) until all funds are exhausted.

Priority 1
- telecommunications services
- local and long distance
- wireline and wireless
- voice, data, video
- Internet access

Priority 2
- internal connections (switches, hubs, routers, wiring)
- basic maintenance on internal connections (only necessary basic maintenance services are eligible)

All transfers of equipment purchased through E-rate are prohibited for three years, without regard to whether money or anything of value has been received in return.

Starting with school year 2005-2006 (E-rate Funding Year 2005), individual schools can receive Internal Connections commitments no more than twice every five funding years. Basic maintenance on Internal Connections is not subject to the twice every five years rule.

The E-rate program requires many different forms. Many E-rate forms can be completed and submitted online. Filing online speeds processing and reduces errors.

The E-rate program is a complicated and record keeping intensive program. To be eligible for the E-rate discounts, a district must:
- have an approved technology plan
- use competitive bidding
- certify that it has the resources to pay its share
- notify the E-rate program when services begin
- maintain records for 5-7 years
Increasingly the E-rate program has been performing competitive bid audits to ensure fair and open competition, certification audits to confirm that the district has/had the resources to pay for their commitments, and on-site audits that validate that the claimed purchases are installed where the district said they would be. This trend will only increase.

**Technology Plan**

Technology plans must be written and approved by the district before the competitive bidding process can begin. The technology plan must:

- establish clear goals and a realistic strategy for using telecommunications and information technology to improve education
- include an assessment of the telecommunication services, hardware, software, and other services that will be needed to improve education
- provide for a sufficient budget to acquire and support the non-discounted elements of the plan: the hardware, software, professional development, and other services that will be needed to implement the strategy
- include an evaluation process that enables the school or library to monitor progress toward the specified goals and make mid-course corrections in response to new developments and opportunities as they arise
- include all components required by the state for state approval

Technology Plans must be approved by the state before the district can receive E-rate funds.

**Competitive Bidding**

In the Telecommunications Act of 1996, Congress directed the FCC to “establish competitively neutral rules . . . to enhance, to the extent technically feasible and economically reasonable, access to advance telecommunications and information services for all public and non-profit elementary and secondary school classrooms . . . and libraries.”

The E-rate program requires an open and fair competitive bidding process. It requires price to be the primary factor in bid evaluation, but need not be the exclusive factor. Price must be given more weight than any other factor.

FCC Rules require an applicant to sign a contract prior to the submission of a request for funding. The FCC’s Fifth Report and Order requires both the applicant and service provider to sign the contract prior to submitting a request for funding.

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Certification that District has its Share of Costs

Districts must be able to show that they have the money to pay for their non-discount share when they file the Form 471. Grants must be secured at the time of filing. Applicants must be able to show that they have computers (or funds to pay for them) to connect to the network connections being requested. Applicants must have reasonable plans to fully utilize all internal connections for which they are requesting discounts. Applicants must be able to demonstrate that there is sufficient electrical capacity to run the computer and/or telecommunications network. Applicants must be able to show that they have resources in place to maintain end user equipment.

Notification that Service Delivery has Begun

The district may not receive E-rate funds before its Technology Plan is approved by the state. Even if services have started and the E-rate program has received a Funding Commitment Decision Letter, the district is not eligible to receive the funds until state approval of the technology plan.

The district notifies the E-rate program that services have begun using Form 486. If this is not done in a timely manner, the district will lose funding.

The FCC rules require the notification to be postmarked no later than 120 days after the Service Start Date (or 120 days after the date of the Funding Commitment Decision Letter, whichever is later). If the notification (Form 486) is submitted later than these deadlines, a date 120 days before the Form 486’s postmark date will become the start date for discounted services and the district will lose funding for the earlier time period.

Records Retention

Documents relevant to a funding year must be retained historically for five funding years. Since all documents relevant to a funding year must be kept until the end of the funding year (which can go through September 30 for internal connections) and the technology plan, bidding and applications occurred up to a year before the funding year began, this effectively means that many records have to be retained for up to seven years.

Good recordkeeping is essential. The following records must be retained for 5-7 years for products and services purchased with E-rate funds, including:

- Copy of Technology Plan approval notification
- RFPs, bids, quotes, proposals, evaluation criteria, etc.
- Competitive bid documents submitted (both winner and losers) and evaluation worksheets
- Signed contracts
Service provider bills to customers
Detail of services/products and locations, indicating the entity(ies) receiving service/products
Delivery/installation dates
Asset and inventory records sufficient to verify actual location of the equipment
Applicant payments
Cancelled checks
Service credits for any reason

The research and best practice information in the following section supports recommendation BFT-6: Expand Focus of District E-Rate Group.
APPENDIX A: REFERENCES

M-DCPS Documents Consulted

District-wide Information Technology Change Control Strategy
Doing Business with M-DCPS
EHandbook List
Five-year Capital Plan
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