

MEMORANDUM

TO: Members, Board of Education

FM: Peter P. Horoschak, Ed.D. Superintendent
Marge Mingin, Ed.D. Director of Educational Media & Technology

DT: February, 2007

RE: BUDGET ANALYSIS #8 – TECHNOLOGY

The Board of Education requested a report on the impact of recent investments in information technology on student and staff achievement and on operating efficiency. The following report provides the current status of educational technology programs including an overview of the technology being used, the NJ Core Curriculum Standard 8.1: Technological Literacy, current digital databases subscriptions, other resources and costs, curriculum/instructional strategies, assessments, and professional development presently being implemented for staff and students as well as recommendations for information and communication technology needs. All components address and impact achievement and operating efficiency.

INTRODUCTION

Computers and computer networks have been used for administrative and student learning purposes since the early 1980's in our district. The first student information system, Columbia Computing System (CCS) and library circulation/catalog system, Columbia Library System (CLS) were implemented in 1984 and 1990 respectively. Both of these legacy district-wide computer systems provided the foundations for the continual growth of our present digital information and communication systems.

When the school bell rang on September 6, 2006, the South Orange-Maplewood School District began the school year with its updated Technology Plan, 2004-2007 nearly completed and operational. It has taken a decade and \$12 million dollars to accomplish. We now have the following in place:

- A networked computer is on every teacher's desk. (The goal is to have most of our installed base using thin-clients.)
- Every teacher has access to **CLASSxp** for viewing and entering necessary student attendance and progress information online.
- A TV is connected to the computer in every classroom.
- Internet access is available for all students and school employees.
- Web-access e-mail accounts are available for all school employees. (Web-access Outlook, 1/1/07)
- Telephones and voice mailboxes are available in classrooms and offices for all staff.
- District e-mail/voice directory is on the Home Web page.
- **Edline portal** is available for CHS staff, students and parents.
- Daily attendance is taken electronically in all schools and period attendance is taken electronically in the high school.
- Progress reports and report cards are entered on-line, processed, and mailed (Print-to-Mail), centrally for the high school, middle schools and all elementary schools.

- Phone notification systems are in our secondary schools that call home to announce student absences and school events. E-mail messages are sent concomitant with voice messages.
- Photo ID system is in place at the high school.
- Security systems are in place in all schools but need to be expanded in the elementary schools to include monitoring cameras.
- Distribution systems are in all schools that include closed-circuit television communication within schools as well as across the District.
- More than \$80,000 in grants, donations and budgeting funding has been spent to provide two state-of-the-art high school television studios and computer editing labs. In addition to the Columbia Cable Network (CCN) of the Television Arts Program, the facilities support the SOMAcom community television program. A Princeton server and new cable line connection support storage and transfer of all video programs and projects.
- A District website has been operational since 1997 that provides Board of Education information, district information and web pages for each individual school. It is in the process of being redesigned. From the Libraries link the website also supports access links to over 40 online research databases for student and staff use in school as well as from remote locations. E-Boards are used for instruction by all media specialists. A Union catalog link of all District library holdings is also on the Home Page as well as a Union video/DVD catalog from which materials can be requested.
- A WAN (wide area network) provides access to Citrix-Metaframe presentation servers and software applications (student and administrative software) and the Internet servers.
- All libraries have OPAC computers with access from computer labs.
- SMART Boards that utilize interactive touch screen technology are presently in the high school library (2) and are being installed in all K-8 media centers.

That's the good news. However, there are still other goals to be met if the challenges of supporting a 21st century digital informational learning environment are to be addressed in a cost effective and academically successful manner for members of the learning community. The primary task ahead is to implement what research has identified as key pedagogical strategies to make technology a wise investment as an effective educational tool. Numerous research studies (WestEd, 2002) report that technology has proven to have a positive impact on promoting higher order thinking skills, student motivation, and improved self-concept.

Every three years state and federal departments of education require that each district revise an educational technology plan. The latest update of the three year technology plan (July 1, 2007 through June 30, 2010) will focus heavily on professional development and instructional technology integration and assessment. It will address the analysis that follows, "***The Learning Return on Our Educational Technology Investment.***" The following analysis' title is similar to a research study by WestEd RTEC's, 2002 as well as including the following excerpts from it:

"The following message that can be gleaned from most current research on the implementation of computer-based technology in K-12 education is that technology is a **means**, not an end; it is a **tool** for achieving instructional goals, not a goal in itself. In today's world, computer-based technology is not a frill, but an important component of any 21st century curriculum. In order to understand the impact of technology on education, it is helpful to consider the purposes to which technology is applied. One distinction comes from Thomas Reeves (1998) who describes learning "from" computers as different than learning "with" computers. When students are learning "from" computers, the

computers are essentially tutors. In learning “with,” by contrast, the students use technology as a tool that can be applied to a variety of goals in the learning process, rather than serving simply as an instructional delivery system. Students use the technology as a resource to help them develop higher order thinking, creativity and research skills.”

The crucial elements for successfully using technology include the following:

- Technology is best used as one component in a broad-based reform effort.
- Teachers must be adequately trained to use technology.
- Teachers may need to change their beliefs about teaching and learning.
- Technological resources must be sufficient, reliable, and accessible.
- Effective technology use requires long-term planning and support.
- Technology should be integrated into the curricular and instructional framework.

Assessing the benefits of using instructional technologies is harder to quantify than basic skills. Current instructional technologies can give visual representation to high-order concepts, use graphics and simulations to link mathematical concepts to real-world applications, provide tools for data analysis which can reveal subtle patterns in data, and supply contextual information through interactive dictionaries, encyclopedias, and similar resources. With technology, students can spend less time doing calculations and more time creating strategies for solving complex problems and developing a deep understanding of subject matter. Word processors have greatly simplified some aspects of writing, editing, and rewriting. Video has long been a way to present unfamiliar material that would be difficult to conceptualize when presented verbally, and today’s interactive video combines the power of visual presentation with the interactive and information-processing capabilities of the computer.

With the Internet, students can have access to their own school libraries, as well as libraries much more extensive than the libraries in their school or communities, and take advantage of information that is up-to-date, not found in textbooks. Interactions through e-mail between teacher and student have been shown to be motivating factors for students to improve their reading and writing skills.

One of the most powerful uses of technology in education is to tailor instructions to students’ individual learning needs. Technology can provide differentiated instruction to accommodate students’ various learning styles. Gifted students can work at their own pace and explore subjects in more depth. Technology can also analyze and provide immediate feedback on performance, and suggest modifications in instruction where necessary to improve student achievement. Online sites are available 24 hours a day for students who need additional instructional support. The combination of computerization, connectivity, visual and multimedia capabilities, miniaturization, and speed has radically changed the potential for technologies in schooling.”

Perhaps the most important conclusion that can be formed regarding the effectiveness of technology as applied to student achievement is that technology won’t make a difference unless school districts make a substantial commitment to a high speed fiber-optic infrastructure that allows for fiber strands to transmit light which carries the data (text, voice and video) transmission at extremely high speeds and providing help for teachers to go beyond the basics of mastering hardware and software but with pedagogy where teachers feel comfortable with instructional designs and assessments of learning.

New Jersey Core Curriculum Standard, 8.1 – Technological Literacy

New Jersey has Technological Literacy Standards that are in NJ Statute regarding alignment with district curricula. The federal law, NCLB, Title II-D, requires all students to be technologically literate by the end of eighth grade by 2014. NJ Standard 8.1 – Computer and Information Standards are listed below:

Technological Literacy

STANDARD 8.1 (Computer and information literacy) All students will use computer applications to gather and organize information and to solve problems.

Descriptive Statement: Using computer applications and technology tools students will conduct research, solve problems, improve learning, achieve goals, and produce products and presentations in conjunction with standards in all content areas, including career education and consumer family, and life skills. They will also develop, locate, summarize, organize, synthesize, and evaluate information for lifelong learning.

Strands and Cumulative Progress Indicators

Building upon knowledge and skills gained in preceding grades, by the end of **Grade 8**, students will:

A. Basic Computer Skills and Tools

1. Use appropriate technology vocabulary.
2. Use common features of an operating system (e.g., creating and organizing files and folders).
3. Demonstrate effective input of text and data, using touch keyboarding with proper technique.
4. Input and access data and text efficiently and accurately through proficient use of other input devices, such as the mouse.
5. Create documents with advanced text-formatting and graphics using word processing.
6. Create a file containing customized information by merging documents.
7. Construct a simple spreadsheet, enter data, and interpret the information.
8. Design and produce a basic multimedia project.
9. Plan and create a simple database, define fields, input data, and produce a report using sort and query.

10. Use network resources for storing and retrieving data.
11. Choose appropriate electronic graphic organizers to create, construct, or design a document.
12. Create, organize and manipulate shortcuts.

B. Application of Productivity Tools

Social Aspects

1. Demonstrate an understanding of how changes in technology impact the workplace and society.
2. Exhibit legal and ethical behaviors when using information and technology, and discuss consequences of misuse.
3. Explain the purpose of an Acceptable Use Policy and the consequences of inappropriate use of technology.
4. Describe and practice safe Internet usage.
5. Describe and practice "etiquette" when using the Internet and electronic mail.

Information Access and Research

6. Choose appropriate tools and information resources to support research and solve real world problems, including but not limited to:
 - On-line resources and databases
 - Search engines and subject directories
7. Evaluate the accuracy, relevance, and appropriateness of print and non-print electronic information sources.

Problem Solving and Decision Making

8. Use computer applications to modify information independently and/or collaboratively to solve problems.
9. Identify basic hardware problems and demonstrate the ability to solve common problems.
10. Determine when technology tools are appropriate to solve a problem and make a decision.

This Standard is benchmark at grades 4 and 12 in addition to grade 8 whose indicators are listed above.

DIGITAL RESOURCES

The department allocates approximately \$24,000 for digital research and instructional resources that are used by students and staff both in school and remotely. These resources are extremely cost effective considering the limitations of the “one volume, one user” restrictions of print reference materials. With nearly 7,000 users the cost is about \$3.42 per user not including parents who can also utilize these resources. There have been **NO** additional budget costs for these purchases. Funds previously used to purchase print reference material have been redirected for purchase of digital ones. Our average utilization numbers for both internal and remote usage is about **30,000 sessions per month**. A partial listing of our web-based databases posted on our libraries’ home page includes:

Annals of America	Opposing Viewpoints
Country Watch	Proquest Historical Newspapers
CQ Researcher	Science Online
Culture Grams Online	Student Resource Center Gold
Ebscohost	Today’s Science
eLibrary	World Book Encyclopedia
Health Reference Center	History Database Center
History Center-US	Literary Reference Center
Litfinder	NetTrekker (Differentiated Instruction/ESL version)
New York Times Online	

In addition to these databases that provide resources for each content areas, there are software applications on users desktops (Citrix) that are productivity tools including Word, Excel, PowerPoint, Publisher, Inspiration (graphic organizer), Visual Thesaurus, and Library World for students/teachers and CLASSxp and Integrate Pro for teachers. The cost of these applications is through a district user license. Every user has a folder on the district’s network. The value and usage of these applications are described in the introduction of this analysis. CLASSxp and Integrate Pro are the district’s online attendance and grading applications with annual maintenance costs of less than \$2,000. There are also a variety of curriculum integrated software titles that are used in the math, science, business and media departments at the high school and middle schools, including Geometer’s Sketch Pad, Chemistry, Physics, Peachtree, and Adobe Premiere. There is no annual fee after the initial purchase of about \$20,000. The high school guidance center uses Naviance and the entire school district uses SASI for its student information system. Annual support for these applications is about \$45,000. In our elementary schools since Citrix does not support many of the older CD programs a special interface “River Deep Software Manager” is utilized to access about 20 programs. There is no annual support cost for this system beyond the initial purchase of about \$20,000 for all programs, K-5.

The reality of the education world is that in a period of five or six years, most reference print materials that have been the bedrock of schools and libraries will be out-of-print. Publishers have been migrating the majority of their publications to digital format for the past decade. With budgets being capped over the past five years the cost of keeping reference sources current for all libraries is cost prohibitive and

replacements would reduce the purchase of fiction materials that are already maintained at levels below average consumption. **The purchase of digital resources has been both cost effective and educationally beneficial.**

The **Information Technology Literacy curriculum** has been updated. It is aligned with the NJCCCS' required skills to access, retrieve, evaluate, synthesize, and document digital sources. While still a national standard, the Dewey Decimal Classification system (DDC) is becoming less important to know in a digital global society. Information is retrieved through **federated searching** and tagging of personal selection of data. Authentication and verification of authorship and veracity of information is paramount for our students to be able to decode. Critical thinking skills are essential to learn and are embedded in all high stakes tests.

Nearly 75% of current reference materials are accessed from our district's web Home Page or from our Citrix network. Curriculum applications are available to ALL students in the district schools and nearly all of our databases have licenses for remote or home access.

Available on our network are curriculum content applications such as:

Math (HS/MS) – Calculus Tools, Fathom, Green Globes, Math for the Real World, Mathematica 5, Minitab 14, Sketch Pad, and True Basic

Science – Active Chemistry, The Central Science, Graphical Analysis 3, Interactive Physics/Simulations, Logger Pro 3, and The Way Things Work plus Science databases

English – The HS English department requires that all student papers be submitted to **Turnitin.com** plus English databases

Social Studies - Digital databases including primary and secondary sources

Business - Peachtree Accounting plus various websites for securities & exchange

Television Arts – Adobe Premiere

Guidance – Utilizes a tracking and information database Naviance for college information and the college application process. This coming spring it will be used by students for course selections

General – E-Board's used by all media specialists & technology integration trainers and an **Edline** portal used by high school students, teachers and parents all accessed from the Home Page

In addition, the secondary schools utilize over 40 databases, covering all content areas, as well as hundreds of websites that are authenticated before being posted on library e-boards or portals that are created by the media specialist in collaboration with content teachers.

The budget for reference materials for all district libraries has not increased for the past decade, yet the flat budget buys the information rich digital reference sources now available to ALL our students in our schools plus remote access as opposed to the print format which would only be servicing "one volume -one-student at a time."

As comparable information now obtained from software and print are upgraded to digital format, **savings and access/equity benefits continue to increase.**

Our elementary Information Technology Literacy program is in transition. Curriculum software is not readily compatible with the thin client network environment. Upgrading programs for a media format that is also rapidly becoming “out of print” is no longer economical for publishers. The programs that have become standards in our elementary labs will not run on XP/Citrix. The programs that will run on XP are using River Deep’s Student Center interface.

All district computers have intranet and Internet access with productivity software that allows staff and students to develop skills and to design products that document learning. Teachers and students have links on our library websites and access to programs on network servers to meet both content and technology tools to meet both content and technology literacy standards such as:

- Exploring patterns of light and conducting basic research on science topics such as color (http://www.exploratorium.edu/exhibits/mix_n_match).
- Analyze geometric forms that offer a basic understanding of the structure of geometry
<http://www.handsonmath.com/PAGES/Gallery?Small%20Cube%20Box/index.htm>
- Additional support for math operations <http://www.hotmath.com> or <http://www.mathground.com>
- Practice using Spanish vocabulary, role playing a dialogue, researching Latin American countries and culture (www.quia.com) which our middle and high school world language use.
- Identify body parts through interactive site (<http://www.innerbody.com>) or fantastic images of human body parts (<http://www.anatomyatlases.org>).
- Convert distance, area, weight, speed, temperature as well as fractions to decimals (<http://www.sciencemadesimple.com/conversions.html>).
- Convert more than 180 world currencies (<http://www.xe.com/ucc/full.shtml>). Find information on nearly 7,000 living languages (<http://www.ethnologue.com>)
- Looking for a particular work of Shakespeare (<http://www.gutenberg.net>)

This spring the department of Educational Media & Technology will administer the first state required assessment of eighth graders’ **NJCCS 8.1, technological proficiency**. The department also will complete the fourth **Educational Technology Plan** mandated by the federal government, a requirement for state and federal funding. The Plan will reflect the milestones in changing the entire information literacy instructional landscape of the district both administratively and instructionally. Likewise, it will address the areas that require further implementation in order for the infrastructure’s ability to support greater broadband and **Internet 2.0** resources and the district’s ability to provide access to the US DOE’s endorsement of **NIMAS** Statute (National Instructional Materials Accessibility Standard) within the reauthorization of the Individuals with Disabilities Education Act. This endorsement has been expanded to be the preferred approach for publishers for all student resources K-12.

CURRICULUM/INSTRUCTIONAL STRATEGIES

The Technology Literacy Information Curriculum which includes the NJCCCS 8.1 addresses the skills and knowledge applications that our students require. In the past the media specialists taught the library information skills. Beginning this school year the **media specialists are also instructing every student in grades 3-5 the computer skills required in standard 8.1**. They are meeting monthly with fourth grade

level teachers to ensure that these skills are integrated with classroom content. Utilizing differentiated teaching techniques, the media specialists work with students to ensure that every 3-5 grade students will meet the proficiencies indicators in word processing, spreadsheet, and presentation skills as well as present:

1. Multiple means of representation, to give learners various ways of acquiring information and knowledge;
2. Multiple means of expression, to provide learners alternatives for demonstrating what they know, and
3. Multiple means of engagement, to tap into learners' interests, offer appropriate challenges, and help to increase motivation.

There is no formal technology skills course being taught at the middle schools. Middle school media specialists implement the information literacy portion of the standard but not the "productivity tools." They do, however, support classes using these tools as much as possible. The technology skills course was recommended to begin two years ago. With the required state testing beginning this spring this course needs to be instituted for the 2007-08 school year as a part of the "cycle" schedule.

Instructional department members utilize a **Collaborative Planning Organizer** when working with teachers. It is an integration strategy that offers suggestions to utilize ways to use technology to improve learning.

SIX CHARACTERISTICS OF HOW TECHNOLOGY CAN AFFECT LEARNING:

1. Use **clear goals** as you design learning through technology.
2. **Match** the learning goals to the learning tasks.
3. Design real/authentic **tasks**. What technology best suits the projects.
4. Use active **inquiry** to have students develop questions that lead to higher-order level thinking.
5. Help learners to develop complex and accurate **mental models** of content that they are studying.
6. Have students work in **groups**, as well as **individuals**. Modify lessons to include whole/half class computer sessions. Include presentation time so that students can demonstrate their learning.

Since nearly half of the student population are visual learner it is important that the use of visual information display tools are used to make online teaching more effective and engaging. High speed Internet connections are needed to display results through physical representations. Students are able to see their search results in easily accessible topics and subtopics. Actual documents are linked to the search results allowing for immediate evaluation of usage of the source. Major visual search tools such as **Grokker** are also meta-search engines that derive content from multiple sources simultaneously. Several of our databases utilize Grokker.

This spring a technology -integration focused "**Understanding by Design**" will be introduced as a course among the many in the district's staff development course offerings. Understanding by Design (UbD) is a framework for improving achievement in schools. It emphasizes the critical role of the teacher as a designer of student learning. It support the concepts and strategies of content-technology integration that **students learn best by doing** and students need to do their own searching, thinking, and producing. "**Learning how to process information and draw conclusions is one of the most important outcomes of education, as opposed to only getting predigested content from text and teachers.**" (Odvard Egil Dyrli, 2007)

ASSESSMENTS

While it might be assumed that today's students learning and living in our digital society might be completely fluent with information technology, research shows that this is not the case. Students today are fairly facile in downloading music into iPods, instant messaging, creating video pods, building their site on Myspace and Googling. They are lacking, however, in the skills that are required for college research and the workforce such as accessing, managing and evaluating information. They are weak in oral and graphic presentations. Their focus and filter research skills need continuing application across the curriculum.

Assessment is an ongoing and integral part of any instructional program. All four types of assessment need to be part of any lesson (assessing familiarization with the topic/skill, determination of link to prior knowledge; formative or checking for understanding throughout the lesson; and summative assessments). Summative assessment details the progress students have made by the end of a unit or lesson. Various forms of assessments include rubrics, checklists, rating scales as they relate to a scenario where technology skills need to be demonstrated. Graphic organizers and concept maps and models are ways to demonstrate search strategies. A rubric is used to assess web sites; a checklist for a power point presentation, and a rating scale for an electronic research paper. The "electronic" research paper is a new high school initiative in collaboration between the social studies department and the media center this year. Using PowerPoint to assist with oral presentations, students successfully demonstrate their learning in an interactive manner. Students use the wide- screen plasma display to present their slides (a synthesis of their research), which are hyper-linked to Internet sites and/or video clips to illustrate a variety of information. Students enjoy the ease of the use of the tools as they build confidence in themselves through their oral presentations. Similar presentation concepts and tools are being used in the middle and elementary schools.

The department will be using in-house designed assessment for our fourth and eighth grade test in spring. In the future commercial assessments such as K to the 8th Power and Information (www.kto8.com) and communication literacy (www.etc.org/ictliteracy) might be utilized. The New Jersey Chamber of Commerce has a "Technology Challenge" (www.LearnDoEarn.org/TechnologyChallenge) for 7 -12 grade students. The NJDOE Standard 8.1 test has not yet been set.

STAFF DEVELOPMENT

Staff development is an essential component of any technology integrated instructional program. **Staff development** opportunities are provided during the school year on curriculum Tuesdays and district professional development days. Additional opportunities are planned throughout the year. This year our technology integration trainers have been providing technology staff development to all fourth grade level teachers in order to ensure that both students and teachers are proficient with standard 8.1 indicators at the fourth grade benchmark.

After school technology courses offered each spring provide a selection in the use of various applications and integration strategies for use by teachers and staff. Additionally, this year all teachers have been provided with a "**Blue Book**" or a documentation booklet that contains all necessary step-by-step directions for using critical mission computer tasks such as grading, attendance, emergency information, etc. Many of the documents are done in flowchart or snapshots of screens. **Flowcharts** offer the opportunity to graphically represent information in a simple, graphic format. We also encourage teachers to use this as a teaching strategy or tool to aid instruction.

Our staff development budget which runs about \$30,000 was previously enhanced with state & federal funding (DLNA, NCLB) but no longer is available.

RECOMMENDATIONS/BUDGET

The fundamental teaching principal “Students learn best by doing,” is consistently confirmed in educational research. This is clearly validated when students are learning technology information literacy skills. Learning how to access and process information, draw conclusions and demonstrate findings through technology integrated applications is essential for 21st century education. The district technology communications infrastructure needs to support full implementation of this learning principal in a timely and accessible fashion 24/7.

DISTRICT

The one basic upgrade that the district’s infrastructure needs is to increase its broadband capacity. If our resources are truly going to include multi-media that provide for differentiated instruction resources, our networks need to be able to have large enough throughputs. We can no longer be a one lane highway. We need several lanes for voice, data and video and EZ Pass capabilities for remote access from home or anywhere. The cost of installing a **fiber network** is a major expense but who that will provide the best solution for our technology needs. Bonding for a fiber upgrade should be considered and could be a multiple-year project (approx. **\$630,000**). Our neighboring communities Montclair, Verona, and West Orange have implemented this fiber optic network in their towns. Such cooperative connectivity is both efficient and cost effective.

Moving the administration technology for student information and student services from an intranet to an Internet platform would be the purchase of a web-based program that meets the needs of the educational community’s (teachers, parents, administration and students) remote access services. This one program would replace the need to have many individual packages such as Integrate Pro, as well as Edline the current program being supported by the HSA for CHS (Parent component) that includes teachers posting lesson plans, grades, course resource links, etc. **Power School** is the recommended web-based student information system (SIS) package that is approximately **\$130,000**. Power School is now owned by the publisher of our current system SASI NCS Pearson.

ELEMENTARY SCHOOLS

Keyboarding is a required skill for all students best taught at 3-5 grades. Only one school has enough individual “Writer Instructor” keyboards with the installed 16 lesson program for teaching proper keyboarding skills. These students are proficient in keyboarding. Grants have written to obtain the necessary funds to bring this technology to our remaining 3-5 schools but were not awarded. Total cost to supply the remaining schools with this technology is **\$25,300**.

MIDDLE SCHOOLS

Implement middle school technology skills integration curriculum for grades 6-8. Curriculum & course plan was submitted two years ago. Plans & curriculum need to be started during 2007 with implementation for the 2007-2009 SR. **Curriculum funds are required.**

HIGH SCHOOL

Additional **computers (12)** for the high school library are needed to support instructional technology integration classes. Space is available at computer OPAC pods. Cost is approximately **\$10,000**. The use of the Library Media Technology’s facilities including SMART Boards & multimedia area has doubled in recent years.