2020 VISION: *"Changing the Face of Education in Fayette County"*

WORK GROUP: *Technology*

FINAL REPORT

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Number of Specific Recommendations: 10

It's About Kids

Preface

The technology group is comprised of 40 members, including students, parents, business representatives, university representatives, school staff, and others. Technology was further subdivided into 4 subgroups which ultimately arrived at 10 recommendations. The subgroups and their recommendations are:

1. Curriculum/Technology Integration – Recommendations 1, 2, 3, 4
2. Standards and Assessment – Recommendation 5
3. Current and Emerging Initiatives – Recommendations 6, 7, 8, 9
4. Community Involvement and Sustainability – Recommendation 10

In order to establish a "baseline" and gain a better understanding of the current status of technology in the district, the committee carefully reviewed Fayette County's annual District Technology Assessment (DTA) (Fayette County Public Schools, 2005). Results from the DTA were then compared with recommendations from the National Education Technology Plan (NETP) from the U.S. Department of Education (2004). Those documents formed the basis for the group's subsequent work and helped begin the process of reviewing research on how technology can best benefit the students of Fayette County Schools.

Staff completed a Technology Support Index (TSI) self-assessment (ISTE, 2005) and some of the resulting recommendations are reflected in the research rationale. TSI covers four domains: Equipment Standards, Staffing and Processes, Professional Development, and Enterprise Management.

Recommendations

Group Recommendation Number: 1- Software

Specific Recommendation: Software should be selected for the district, and for individual subjects or grade levels, with teacher and student input, and with specific criteria in mind to keep the software current, compatible, cost-efficient, and highly effective.

Software that is used by most students and teachers, regardless of grade, class or subject. (Currently, this is taken care of by a system-wide license for Microsoft Office and the use of internet browsers that are free or included with operating systems.)

- FCPS should maintain availability of these software programs, recognizing such software to be the new century's equivalent of pencils, paper and books.
- FCPS should upgrade to the newest versions as soon as possible.

- Free and/or open source versions of these programs should be adopted only inasmuch as they are completely compatible with programs used by the majority of working adults in Kentucky and the US.

Software specific to a subject or grade level: Districtwide focus groups of teachers in relevant subjects or grades will keep abreast of and select appropriate software for FCPS for upcoming year(s)

- Software selections will be reviewed every one to three years.
- Focus groups will include students as a "best practice," with the alternative being that software will be tested with a group of FCPS students before wide adoption by the system.
- Software should be selected with these criteria in mind where possible:
  - Current technology, latest releases of software
  - Award-winning in the uses for which it's being selected
  - Based on sound research
  - Open source, free or low-cost
  - Used by benchmark or leading school systems
  - Training available with purchase
  - Matches closely with curriculum content standards
  - Easily upgradeable
  - Works with vast majority of FCPS hardware & systems
  - Addresses a variety of learning styles
  - Works to develop higher-order thinking skills, rather than rote memorization

Research Rationale for how this change will help kids:
Adapted from "Focus on Effectiveness," a product of the Northwest Educational Technology Consortium.

- **Technology applications that enable student collaboration tend to result in improved achievement.** They provide realistic, complex environments by furnishing investigative tools and data resources, and linking classrooms for joint investigations (Means & Olson, 1997; Meyer, 1975).
- **Sophisticated interactive software creates opportunities for students** to learn by doing, receive feedback, continually refine their understanding, and build and represent new knowledge (Barron, Schwartz, Vye, Moore, Petrosino, Zech, and Bransford, 1998).
- **Integration of technology with curriculum increases student achievement.** Significant student achievement gains for technology integrated with standards were demonstrated by an eight-year longitudinal study of SAT-I performance at New Hampshire's Brewster Academy (Bain & Ross, 2000).
- **Well-planned use of computer-assisted or computer-mediated instruction may support a greater rate of student learning than for those without access to such technology** (Schacter, 1999).
- **Technology does affect academic achievement, but is dependent upon how the technology is used.** Grade-appropriate use of computers is more important in producing increased learning than the amount of time computers are used. **Asking students to apply higher order concepts is associated with significant learning gains** (Wenglinsky, 1998).

- According to TSI (ISTE, 2005), "Each application [software program] that is used should be tested before it is introduced for full deployment. A list of tested applications and the known issues should be made available to users. To completely contain technical issues, installation of applications that are not on the list should not be permitted."

Implementation Steps for Recommendation #1	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
1A. Do comprehensive inventory of software being used in FCPS — identify programs properly used only at particular grade levels or in particular subject areas.	Coordinator of Instructional Technology; Instructional Technology Leaders		9/06	4/07
1B. Create task forces for periodic review of software at each grade/age grouping, subject grouping, and system-wide. Task forces should include teachers at relevant levels, and students from grade 4 and above.	Coordinator of Instructional Technology		11/06	4/07
1C. Create timeline & deadlines for periodic reviews, decisions, and acquisition of software in each area.	Coordinator of Instructional Technology; Software Task Force		9/06	10/06
1D. Create scoring method for software being considered, based on relevant criteria (including those in this recommendation).	Coordinator of Instructional Technology; Software Task Force		8/06	10/06
1E. Create funding stream for acquisition and updating of software.	Coordinator of Instructional Technology	KETS, PD, textbook funds as well as other sources of funding	1/06	ongoing

Group Recommendation Number: 2 - Hardware & Infrastructure

General Statement: Technology can only be thoroughly integrated into curriculum as students have access to computers or other content-delivery devices. The committee recognizes that a particular platform or configuration may be advantageous now, but in 5 or 10 years, it may be ridiculously outdated. Therefore we recommend implementation of key principles.

Specific Recommendation: Hardware/Infrastructure — Students should have direct access to computers or other multi-purpose technology devices with a 1:1 ratio of devices to students. This computing power should be sturdy, fully portable, constantly well-connected to adequate resources, and well-maintained.

Connectivity

- Devices should allow access to curriculum and related resources on a location-independent basis — they should connect to resources regardless of what classroom, building or even neighborhood they're in.
- All schools in the system should have internet and intranet access capacity that is not maxed out, except for brief, peak periods.
- Content filters should be used sparingly and with great care, so as to protect students while not limiting their access to a full range of knowledge and connection to the community.

Storage

- Students should have the ability to store and retrieve information related to their schoolwork in a flexible, location-independent manner.
- Storage capabilities should be large enough to accommodate needs of students, teachers and administrators without unreasonable restrictions.

Maintenance — FCPS technology support staff should be maintained at a level commensurate with keeping superior systems working at full capacity. Staff and suppliers should be able to fix hardware and software problems on a same-day or next-day basis. Students and teachers should be able to use backup or replacement systems almost immediately when their usual systems break down.

Research Rationale for how this change will help kids:

- **Digital equity** is dependent on all children having access to—and being ready to use—engaging technology-supported learning opportunities (Valdez & McNabb, 1999).

The following are adapted from Visions 2020.2: Student Views on Transforming Education and Training Through Advanced Technologies — part of the National Education Technology Plan for the U.S. Dept. of Education (U.S. Department of Education, 2004).

- In 2002, 83 percent of family households reported computer ownership, with 78 percent having Internet access. In the fall of 2002, 99 percent of public schools in the United States had access to the Internet, and had expanded Internet access into 92 percent of instructional rooms. Taking advantage of these digital tools, 90 percent of children between ages 5 and 17 use computers, and 65 percent of American children ages 2-17 use the Internet from home, school, or some other location. Internet usage is growing fast among the very young, with parents reporting that 35 percent of children ages 2-5 went on-line, growing from a usage rate of six percent just two years earlier in 2000. Seventy-eight percent of children between the ages of 12 and 17 go on-line.[1]

- **Children are using these digital tools in support of their schoolwork.** Students ages 6-17 who go on-line report educational activities, such as homework and research, among their top five daily uses of the Internet.[2] For example, 94 percent of children ages 12-17 report that they go online to do research for school assignments. In the same survey, 71 percent of students report that they used sources found on the Internet most frequently in the last big report they wrote for school—by far the largest source of information. (In contrast, only a quarter report using books and magazines from a library).[3] Twenty percent of the children who use the Internet at home report that they go online every day for educational purposes.[4]
- More than half of the students have used a web site set up by school or a class, one third have downloaded a study aid, and 17 percent have created a web page for a school project.[5]
- Despite the availability of computers and Internet access in school, the use of digital tools by students is more home-based than school-based. For example, among students ages 12-17 that go on-line from more than one location, 83 percent say they go on-line most frequently from home, and while only 11 percent say they go on-line most frequently from school.[6]
- Computers and the Internet are not the only digital technologies that children use routinely. Of those students answering the NetDay questionnaires, 81 percent in grades 6-12 had at least one e-mail address, and 38 percent in grades 3-5 and 19 percent in grades K-3 had an e-mail address. Seventy-five percent in grades 6-12 had at least one instant message screen name, as did 34 percent in grades 3-5. Sixty percent in grades 6-12 reported that they e-mailed or "instant messaged" adults such as family members, teachers or coaches on a weekly basis. Fifty-eight percent in grades 6-12 have a cell phone. In a survey for the Pew Internet in American Life Project, 41 percent of online teens say they use e-mail and instant messaging to contact teachers or classmates about schoolwork.

According to a study by the Pew Internet and American Life Project, **students rely on Internet technology for school work** for a number of reasons including: to complete their school work more quickly, to draw upon the latest knowledge and sourced information for papers and projects, and to better juggle school assignments and extracurricular activities. Students communicate on-line with other classmates to discuss school projects, upcoming tests and quizzes, homework shortcuts, and school assignment pertinent websites. They also communicate on-line with teachers, tutors, and on-line study groups.[7]

[1] Connected to the Future: A Report on Children's Internet Use, Corporation for Public Broadcasting, March 2003; Young Children's Access to Computers in the Home and at School in 1999 and 2000, National Center for Education Statistics, U.S. Department of Education, 2003; Internet Access in U.S. Public Schools and Classrooms 1994-2001, National Center for Education Statistics, September 2002; The Digital Disconnect, The Widening Gap Between Internet-Savvy Students and Their Schools, Pew Internet and American Life Project, 2002.

[2] Connected to the Future: A Report on Children's Internet Use, Corporation for Public Broadcasting, March 2003.

[3] Parents, Kids, and the Internet, Princeton Research Associates for the Pew Internet in American Life Project, June 2001.

[4] Connected to the Future A Report on Children's Internet Use, Corporation for Public Broadcasting, March 2003.

[5] The Digital Disconnect, The Widening Gap Between Internet Savvy Students and Their Schools, Pew Internet and American Life Project, August 2002.

[6] Parents, Kids, and the Internet, Princeton Research Associates for the Pew Internet in American Life Project, June 2001.

[7] The Digital Disconnect, The Widening Gap Between Internet-Savvy Students and Their Schools, Pew Internet and American Life Project, August 2002.

According to TSI (ISTE, 2005), "Most private industries staff technical support with a technician for every 50 to 100 computers. School districts, on the other hand, will commonly see ratios of 250:1 or greater. It is recommended that technology staffing is prioritized to ensure that downtime is minimized and that staff and students can readily depend upon the district's technology." In Fayette County, the ratio of computers to technicians is approximately 750:1.

Implementation Steps for Recommendation #2	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
2A. Do comprehensive inventory of hardware in FCPS and identify 1) how up-to-date or out-of-date it is, and 2) ratio of computing units to students in school it resides in.	Director of Education Technology, Supervisor of Systems Support	Instructional Technology Leaders	1/06	5/06
2B. Project bandwidth and data storage needs for system, schools & students over the next three years.	Director of Education Technology, Supervisor of Systems Support, Coordinator of Instructional Technology		4/06	9/06
2C. Use peer standards and research to define reasonable levels of staff for maintenance and technical support for a system with 1:1 hardware/student ratio. Develop and adopt a 5-year timeline to bring FCPS to that standard. Minimum suggested ratio of technical support is as follows: High Schools – 1 full-time LAN/WAN technician Middle Schools – 1 LAN/WAN technician for every 2 middle schools Elementary Schools – 1 Microcomputer Specialist for every 3 elementary schools	Director of Education Technology	Technology Support Index: http://tsi.iste.org Note: In order for this recommendation to be successful, it should be implemented in combination with recommendations 3B and 3C.	12/05	ongoing

Implementation Steps for Recommendation #2	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
2D. Study and report on gaps in connectivity to technology resources for FCPS students, both within school buildings and in other locations in Fayette County. Develop and adopt specific recommendations to address each gap.	Supervisor of Systems Support		5/06	9/06
2E. Begin implementation (as funding allows) of equipment purchases and installation of needed hardware to achieve goals and close gaps. Coordinate hiring levels in proportion to hardware acquisitions	Director of Education Technology		7/06	ongoing

Group Recommendation Number: <u>3 - Professional Development & Student Involvement</u>

General Statement: Teachers and students will not be able to teach or learn with technology unless they know how to use it. Training for both groups is essential to curriculum integration.

<u>Specific Recommendation</u>: Students, teachers, administrators, and parents should have access to adequate training on hardware and software used in the school system. Training should be done both in-school and available outside of school. Understanding and use of hardware and software should be modeled from the top down (administration, teachers, and parents), and a proficient level of technology use and integration should be required in all schools. Schools should continue the Student Technology Leadership Program as one method of providing support while building leadership among students.

<u>Teachers</u>

- Off-site or after-hours training on software & hardware should be part of the professional development program for teachers. This should include opportunities to experience and role-play tech-integrated teaching methods.
- On-site or in-classroom help should be provided at adequate levels during regular school hours.
- Teachers should learn how to instruct students on the use of basic and specialized software.

<u>Students</u>

- Students should be trained, early in their school careers, how to use basic software and hardware, like turning on a computer, using a keyboard and mouse, and using web browsers and word processing programs.
- Students should receive adequate training and ongoing support for both basic and specialized programs. This should include both automated resources and in-person support.

- Student software and training should be useable in both formal and informal learning settings, and should be presented in a way that addresses multiple learning styles.

Administrators

- Tech integration won't be adequately stressed or assessed without leadership from the administration. Training and implementation should be applied to administrators as well.

Parents

- Parents and guardians should be oriented to the software their children are using for their work, especially as the software is used at home. Some orientation should be available at beginning-of-year orientations or at open houses. Online help for their children's programs should be available from any location, 24 hours a day.

Research Rationale for how this change will help kids:

"Schools and districts which offer long-term commitments to professional development have the most effective technology implementation. A well-planned, comprehensive professional development plan which assist educators in moving from novice to proficient status, provides students with the best possible learning environment in which to achieve." (Garet, Porter, & Desimone, 2001)

"Additional research shows that teachers who engage in Professional Development which aligns curriculum and state academic standards together, also change their instructional practices and gain greater knowledge in their subject areas. This knowledge empowers teachers to become effective leaders in their fields. This empowerment is then passed to the students who become actively engaged in the learning and assessment process." (Cohen & Hill, 2001)

According to the Leadership and the New Technologies (2000), "To achieve this type of achievement level within our schools and district, goals need to be established to promote this objective. These goals are set but not limited to the following ideas:

- The community must share a vision of what they expect the district to provide in technology for their teachers and students.
- Professional Development in Technology must be integrated into the district's plan to ensure that certain specific goals will be achieved by the used of technology.
- Professional Development in Technology should assist teachers with solving instructional issues and practices which impact learning.
- Professional Development in Technology must be linked to Core Content and Curriculum, thereby allowing teachers to change instructional practices and engaging all students in learning.
- Professional Development in Technology must address activities which provide for hands-on experiences, demos, learning experiences both for teachers and students, reflection and assessment.
- Professional Development in Technology should discuss a plan for each school which includes expectations for teachers and students. Teachers should be aware of these expectations and should reach a certain level of competence each year.
- Professional Development in Technology must develop a plan which is evaluated regularly to assess student performance."

"Simply possessing equipment is not enough: administrative or logistical delays in obtaining equipment and software, and in repairing machines that have broken, cause significant difficulties for teachers. Although educators are resourceful, and remarkably willing to soldier on with outdated equipment, making do as best they can – and indeed to remain purposeful and optimistic while doing so – it is clear from the data analysed here that a lack of appropriate material resources causes frustration, inhibits learning and invites resistance on the part of teachers, students and the community. In addition to material resources, schools need appropriate technical support. At all of the schools studied, the need was expressed similarly: full-time technical support is as necessary as the machines themselves if teachers are to surpass the basic logistical and technical problems of computer use in order to move on to the more significant, and sought-after, components of implementation, namely curricular integration and meaning-making." (Granger, C., Morbey, M.L., Lotherington, H., Owston, R., & Wideman, H., 2002).

According to Ronnkvist, Dexter, & Anderson (2000), "Technology support in America's schools typically comprises access to equipment, dedicated staff, and professional development programming. This support is profoundly resource dependent, as evidenced by the wide range of roles adopted and number of hours worked by those involved with educational technology. Data from the Teaching, Learning and Computing survey in 1998 indicate that teachers' use of technology is positively related to support. Thus, we recommend that technology leaders plan carefully in order to provide a complete set of technology support services. This should include… facilities, staffing, personal assistance, professional development programming, and incentives."

"When the technology support is designed with the instructional needs of teachers in mind–i.e., creating convenient access to necessary resources, providing individualized support, training teachers to integrate technology into the classroom, and providing resources as incentives–the effect on use is pronounced. This underscores the need for a systematic approach to creating support. Indeed, elements need to be provided and coordinated into a larger comprehensive view of what teachers need to make use of technology as an instructional tool."

Since the year 2000, the district's Comprehensive District Improvement Plan (CDIP, formerly called Consolidated Plan) has included recommendations to increase the level of instructional technology support in schools. (Consolidated Plan, 2000-2002, Consolidated Plan, 2002-2004, Comprehensive District Improvement Plan, 2004-2006) Currently, the district is providing a limited number of Technology Resource Teachers (TRT) through a grant and 19 schools fund their own TRT out of their regular staffing formula. Data from Fayette County's annual District Technology Assessment have shown that schools with full-time TRTs use technology more consistently and more effectively. (District Technology Assessment, 2005)

According to TSI (ISTE, 2005), "It is recommended that an effective training program for ALL staff is put into place. This program should include appropriate incentives, accountability, and a diverse set of learning resources…. It is recommended that very basic troubleshooting skills are built into the professional development program, decreasing the number of low-level technical support calls…. It is recommended that a just in time training program is implemented and used as part of the organizational culture."

Student Technology Leadership Program (STLP) is a statewide initiative, the goals of which are to:

1. Develop activities which enhance the academic, social and emotional growth of the student.
2. Provide leadership opportunities for all students.
3. Participate in multi-age collaboration by forming innovative learning partnerships.
4. Form learning partnerships among students with different technology skills.
5. Develop activities which benefit communities.
6. Develop instructional activities which integrates technology and benefits the school and support KETS (Kentucky Education Technology System)

Fayette County has one of the largest STL programs in the state and was recognized in March 2005 with a Platinum Award as one of the most successful programs in Kentucky (http://teach.fcps.net/tips/2004_05/March/stlp.htm). Many of our schools and students have also won individual statewide awards. (http://www.fcps.net/goodnews/20030325.htm). Traditionally, every school in the district has an STL program.

Hodari and Wenger (2002) conducted an evaluation of STLP statewide. According to the report "this program provides substantial benefits to students who participate, coordinators, and schools. The projects and computer maintenance undertaken by STLP students certainly provide substantial spillover benefits to other students in schools with STLPs." Some of the major findings were:

- Students "were overwhelmingly enthusiastic about the STLP."
- "The program has increased their technology-related skills."
- The program has given students "valuable practice in interacting with other students and teachers."
- "STLP provides an opportunity for students to train other students and teachers in the use of technology."
- According to coordinators, "students learn about technology and about leadership through STLP."
- "More than one in four coordinators said that the STLP makes it more likely they will 'remain in the school system.'"
- "STLP groups perform a number of service projects for schools that may include working on the school's website or television station. STLP students often help with the day-to-day computer maintenance in schools."

Implementation Steps for Recommendation #3	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
3A. Review teachers' professional development plans and work with organizers to add software and hardware training to the programs early in the school year.	Coordinator of Instructional Technology, Technology Resource Teachers or similar personnel	Principals	9/06 and beginning of each school year	ongoing

Implementation Steps for Recommendation #3	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
3B. Convert School Technology Coordinator positions from supplemental to regular positions. The new position would be called Instructional Technology Leader (ITL), and they would assume a wider range of responsibilities and leadership for the building, providing adequate school level instructional support for students, teachers, and administrators. It may be possible to combine responsibilities of some existing positions in order to accomplish this. For example, STC, STLP, webmaster and school-based TRT might be combined into one position. Schools with 1,000 or more students: 2 ITLs Schools with 400 to 999 students: 1 ITL Schools with less than 400 students: .5 ITL	Coordinator of Instructional Technology; building level principals	District Funding Note: In order for this recommendation to be successful, it should be implemented in combination with recommendation 2C and 3C so the ITL can devote most of his or her time to instructional support and leave most technical support to technicians.	8/06	ongoing
3C. Maintain a core group of 5 District Technology Resource Teachers at the district level to support ITLs and provide advanced training.	Coordinator of Instructional Technology	Note: In order for this recommendation to be successful, it should be implemented in combination with recommendation 2C and 3B.	8/05	ongoing
3D. Provide online tutorials for software and hardware being used by students, teachers, and administrators.	Coordinator of Instructional Technology; District Technology Resource Teachers	Commercial vendors of online training. Specialized training developed within the district.	6/06	ongoing
3E. Mandate use of technology for administrators; include this in annual assessments for them as well as for teachers.	Superintendent; School Directors; Coordinator of Instructional Technology	District's evaluation system	7/06	ongoing

Implementation Steps for Recommendation #3	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
3F. Provide parent orientation to software and hardware being used by their children. Do this early in the school year, and make them aware of online resources for further training.	Instructional Technology Leader (ITL)	Family Resource and Youth Service Centers	9/06 and beginning of each school year	ongoing
3G. Assess the need for student training in software and hardware at different age levels. (See recommendation 5A regarding technology standards for students.)	Coordinator of Instructional Technology, Instructional Technology Leader (ITL)	International Society for Technology in Education	8/06	ongoing
3H. Develop a tool to assess teachers and administrators on effectively integrating technology. Teachers and administrators need to be proficient technology users themselves in order to promote better technology use among students.	Coordinator of Instructional Technology, District Technology Resource Teachers	There are several resources for this, such as the School Technology and Readiness (STaR) Chart http://www.iste.org/starchart/, University of Memphis observation system, and Apple Classroom of Tomorrow scale. Various options should be compared and results should be included in the District Technology Assessment.	8/06	5/07
3I. Continue job-embedded Professional Development to support teachers meeting both student standards and KY teacher standard 10. This will require restructuring of school staffing as indicated in recommendation number 3B.	Coordinator of Instructional Technology, District Technology Resource Teachers		8/06	Ongoing

Implementation Steps for Recommendation #3	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
3J. Continue the Student Technology Leadership Program (STLP) in all schools, including funds for materials. If the recommendation for ITLs is implemented, it may be possible to eliminate the supplemental pay for the STLP Coordinator and use those funds to offset some of the salary of the ITL, with the ITL assuming responsibility for coordinating STLP.	Instructional Technology Leader			

Group Recommendation Number: 4 - Portability and Access

General Statement: These points may have been made in the preceding three recommendations, but they are repeated here for emphasis and elaboration.

Specific Recommendation: Students should be able to use their hardware & software in the classrooms, in study hall, in the lunch room, on the bus, at home, and at other locations. Parents should be able to learn what their children should be doing in class at any time through the use of technology.

- Students should be able to use their hardware & software in the classrooms, in study hall, in the lunch room, on the bus, at home, and at other locations. Technology can only be truly integrated into curriculum when it is accessible at all times the student needs to work on it.
- Parents should be able to learn what their children should be doing in class at any time through the use of technology. Classroom websites with assignments, lesson plans, and resources would be a good start (some are already in place), along with other methods of communication like parental notification email systems.

Note: Assessment and Refinement
Our group wants to emphasize that these recommendations should be reviewed and assessed at least every few years, to find out:

1. If they are being implemented, and
2. When implemented, are they effective?

Changes should be made according to the findings of that periodic review.

Research Rationale for how this change will help kids:

The first excerpts dealing with portability are from the Kent (1995), perhaps originally directed toward post-secondary matters. However, given the importance of developing "pipelines," as well as the quantum leaps since this article, we can hopefully glean applications relevant to current education.

"The advantages of using worldware over bespoke software include: the mass-market sales of worldware products mean that prices are (relatively) low, and they ensure survival of the products through hardware and operating system upgrades, portability across all common hardware and software platforms, and continuous improvements to performance (think of the competition between WordPerfect and MS-Word, or between Mathematica and Maple); teachers use the products as everyday tools for research, teaching or administration and so develop the experience and expertise required to take-up and adapt CBL materials created by other people-so teachers are empowered; these products are powerful pieces of software whose functionality goes beyond what CBL materials do with them; students develop skills in using the software which they can apply directly in studies and work later in their careers. Indeed we can soon expect all undergraduates, and their future employers, to be demanding proper training in appropriate software during degree courses."

"The other portability question, that of making learning modules work with different CAS's-Maple especially-is a harder one, which we hope to address in future work. There is some hope on the far horizon in the form of the OpenMath initiative, which aims to create a communication standard between all mathematical software. Under this, portability between different CAS's could be made virtually complete. Let us hope that something like this comes about, to bring CAS's on a par with the portability of data for spreadsheet and word processor software. "NB: In Kent's article, Bespoke refers to "specially written" software, as opposed to the more generally available "worldware." CAS is Computer Algebra System, and CBL is Computer-Based Learning, usually in module format.

This link presents suggested critical success factors for improving accessibility of technology to students:
www.utoronto.ca/atrc/rd/library/papers/accesscurric.html

"Automating Validation of Accessible Web Pages - Tools must be provided to ensure that HTML markup is in compliance with WAI (Web Accessibility Initiative) guidelines.

Accessible Courseware -Courseware utilities and communication tools must have accessible user interface.

Accessible Curriculum Formats -Interactive components and multimedia elements must be presented in accessible formats."

Other links to discussions/articles regarding portability, accessibility and individualization:
www.electronic-school.com/2001/03/0301f4.html
www.catea.org/grade/accessibility.html
www.wcschools.com/mjhs/tlcf/integration_rubric.htm *

Implementation Steps for Recommendation #4	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
4A. Identify gaps in student access to portable computing and the Internet.	Instructional Technology Leader		1/07	3/07
4B. Plan and implement action steps to fill gaps in portability.	Instructional Technology Leader		3/07	5/07
4C. Review parent access to information about classroom / curriculum activities of their children; identify gaps; develop plan to fill gaps.	Instructional Technology Leader		1/07	3/07

Group Recommendation Number: 5 - Standards and Assessment

Specific Recommendation:

Fayette County should adopt the National Standards for technology. The skill sets from the previous Fayette County standards should be revisited and aligned with these National Standards. Consider assessing students on those standards. The alignment should be regularly revisited as the National Standards are updated and changed.

Research Rationale for how this change will help kids:

A set of technology standards was developed by staff of various schools and the technology department in 1998. (http://teach.fcps.net/standards/) The standards were reviewed by site based councils and approved for implementation by every council in the district. The standards were designed to support student achievement in all areas – not just technology. For example, the standards call for students to be able to keyboard with a computer at least as fast as they can write by 4th grade. According to a 2000 Boston College article by Russell and Haney, "For students who could keyboard moderately well (20 words per minute or more), performance on computer was much better than on paper. For these students, the difference between performance on computer and on paper was roughly a half standard deviation. According to test norms, this difference is larger than the amount students' scores typically change between grade 7 and grade 8 on standardized tests (Haney, Madaus, & Lyons, 1993, p. 234). For the MCAS [Massachusetts state writing assessment], this difference in performance could easily raise students' scores from the 'failing' to the 'passing' level (Russell, 1999)." Fayette County's standard of keyboarding proficiency by 4th grade (http://teach.fcps.net/keyboarding.htm) is in line with the Kentucky Department of Education's guidelines for computer keyboarding (Kentucky Department of Education, 1997).

In December 2003, the Kentucky Board of Education endorsed the National Education Technology Standards (NETS) for Students. The Board called "for all schools and districts to use the six categories of technology mastery, published by the International Society for Technology (ISTE), as guidelines for planning technology-based core content lessons." (Kentucky Department of Education, 2005). As of May 2005, 47 states and the District of Columbia had adopted student standards for technology (Fox, 2005), so Kentucky is in the majority in this regard.

Currently, there are no data to show how effectively our schools implement the district or national standards. The standards are not incorporated into any required Fayette County, Kentucky, or national assessment. Nationwide, three other states test their students' use of technology - New York, North Carolina, and Utah. Hawaii is also piloting a state technology assessment (Fox, 2005). Within Kentucky, Jefferson County was the first district to implement a standards-based districtwide technology assessment (http://www.jefferson.k12.ky.us) called Computer Applications Skills Assessment (CASA), which is based on their Computer Applications Skills Continuum. Several commercial assessments are available and ISTE provides a free online criterion-referenced assessment that is tied to its student standards (http://www.iste.org/resources/asmt/msiste/).

Implementation Steps for Recommendation # 5	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
5A. Adopt the national technology standards for students, as recommended by the Kentucky Board of Education.	Coordinator of Instructional Technology	Fayette County technology standards: http://teach.fcps.net/standards/ National standards: http://cnets.iste.org/students/index.shtml	1/06	6/06
5B. Develop a grade level checklist of student standards for teachers to reference when instructing.	Coordinator of Instructional Technology	Instructional Technology Leaders	1/06	6/06
5C. Consider assessing these skill sets at the primary, intermediate, middle, and high school levels. Consider using an assessment such as the one provided by the International Society for Technology in Education (ISTE) to achieve this.	Coordinator of Instructional Technology	NETS Online Technology Assessment: http://www.iste.org/resources/asmt/msiste/	8/06	ongoing

Group Recommendation Number: 6 - Physical Infrastructure

Specific Recommendation: Provide a mechanism by which upgrades in technology provide "just in time" infrastructure and software/tool support for current and emerging practices. Provide for continuous assessment of technology use and availability through a process which selects and implements current and emerging technology. This process would use a group which includes all stakeholders, including students.

Research Rationale for how this change will help kids:

With the fast pace of technology change, we no longer have the luxury of designing, financing and installing improvements as they are needed. To improve instructional practice and student achievement, basic technology support must be consistent, useful, and functional, or students and teachers will not use and depend on them ("2001-2006 Master Plan for Education Technology", 2005). Marzano's (1998) research speaks of instructional practices that can contribute to higher levels of achievement. These practices will be enhanced with technology and speak to how students think and learn. Schools must break the tradition of being last to adopt enhancements, and strive to keep ahead of emerging technologies which impact classroom learning, and the infrastructure changes needed to support them.

The TSI survey (ISTE, 2005) recommends a 3 to 5 year replacement cycle for equipment, through leasing or purchase and replacement. TSI also recommends "when appropriate network infrastructure is in place, centralization of servers is implemented."

Implementation Steps for Recommendation # 6	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
6A. Institute a process using a team of stakeholders (including students) by which current and future technologies and practices are assessed and inventoried. This process should use the evaluation of best practices at benchmark public schools, integrated evaluation processes with continuous assessment, and end-of-year evaluation processes by this team. This process would include an evaluation of district support mechanisms and tools, basic infrastructure and hardware concerns, as well as classroom practices.	Coordinator of Instructional Technology	The district has been conducting a District Technology Assessment since 1999, but it has dealt mainly with instructional impact and some infrastructure. It will be expanded this year to encompass the business functions and more detail on infrastructure. We recommend that be further expanded to include the evaluation of specific software and tools.	9/05	ongoing
6B. In keeping with the Kentucky Educational Technology System (KETS) standards, maintain a total wide area network capacity which provides a ***minimum*** of 20% headroom against the ***peak*** demands placed on it, beginning with the Gigabyte proposal approved by the board. When peaks in network use reach 80% of capacity, immediate design changes and upgrades should be implemented.	Supervisor of Systems Support	District Office of Instructional Resources	9/05	ongoing

Implementation Steps for Recommendation # 6	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
6C. In keeping with the Kentucky Educational Technology System (KETS) standards, maintain a total server capacity which provides for a minimum of 40% headroom against the total storage and processing demands placed on it. Provide for a regular upgrade and replacement schedule for core server capacity based on an industry standard of a four year replacement cycle.	Supervisor of Systems Support		1/06	ongoing
6D. Using the process mentioned above, provide for the implementation and support of upgrades and emerging technologies, including systems mandated by KETS, including a minimum 5-year cycle of replacement for all personal computing devices used directly for student work and achievement in the district.	Director of Education Technology	KETS & district funds Grant funds may be used to supplement but should not be relied upon for basic infrastructure.	9/05	3/06
6E. Develop and implement a business continuation plan to ensure that vital functions of the district can continue in the event of a disaster. This plan should include contracted remote-site daily backup of critical data, as well as automated within-site redundancy and system restore.	Supervisor of Systems Support		9/05	9/06

Group Recommendation Number: 7 - Data & Communication Tools

Specific Recommendation: Design and implement a plan for the continuous and flexible support of instruction and educational administration through technology tools, such as content management and media delivery systems. These tools provide for productivity and e-communications, with the goal of connecting students, teachers, parents, administration, support staff, and outside stakeholders with each other, and the materials and results of instruction, and the materials required for instructional capability development.

Research Rationale for how this change will help kids:

Productivity and office efficiency is a pivotal role for technology – a lesson which has been clearly learned and acted upon in almost every other arena outside of education (Dunwoodie, 2005). Content management systems not only provide for a paperless way in

which work can be done, they provide for secure environments and other features to be quickly and easily set up by end users, eliminating the need for web developers and IT professionals to invest time and resources.

Traditionally, schools and school districts gain such technology much later than business or personal home use. Many students have grown accustomed to these tools in their lives outside of school. In order to continue to motivate and enhance student learning, emerging technologies that can impact student achievement and improve classroom management must be implemented.

Technology increases learning opportunities when students use computers at home to continue work initiated in school (Walker, Rockman, & Chessler, 2000). Technology improves performance when used in environments where teachers, the school community, and school and district administrators support the use of technology: (a) integration of technology with instruction, (b) extensive professional development for teachers, and (c) computer use at home and school (Honey, Culp, & Carrigg, 1999). Major implications for educators/decision makers: treat technology as an integral tool for instruction and administration, rather than as an add-on. (Grunwald & Associates, & Rockman, 2002).

Implementation Steps for Recommendation # 7	**Person Responsible for Completing Steps**	**Possible Resources?**	**Start Date**	**End Date**
7A. Implement a centralized library management and content delivery system to take advantage of features not available on the current school-based systems (new version to replace current Follett), as well as provide WAN delivery of video and other instructional media content to the schools and classrooms.	Supervisor of Systems Support, Media Services		10/05	ongoing
7B. Implement a district-wide content management system to improve work flow and information sharing for district offices, and provide a platform for classroom and other instructional collaboration using threaded discussion, blogging, document access, and other online collaborative tools for use by students and teachers.	Director of Student Achievement, Coordinator of Instructional Technology		1/06	5/07
7C. Utilize a content management system to allow for streamlined updating of classroom and teacher public web content and automated delivery of class information such as grades and assignments.	Director of Student Achievement, Director of Education Technology		9/05	3/06

Implementation Steps for Recommendation # 7	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
7D. Consult with KDE on the new Student Information System, with the goal of better access and communication with parents and other stakeholders in classroom performance and practice.	Director of Education Technology	Kentucky Department of Education	8/05	7/06
7E. Encourage all teachers to set up and maintain a classroom web page, to provide the teacher with a vehicle through which he/she can establish a line of communication between school and home. Classroom web pages allow teachers to manage student learning activities in a technology-enhanced environment. With the classroom web page the teacher not only models and teaches legal and ethical practice related to technology use, but also uses technology to communicate and collaborate with peers, parents, and the larger community in order to nurture student learning.	District Instructional Webmaster		8/05	ongoing

Group Recommendation Number: 8 - Ubiquitous Access

Specific Recommendation Students should be provided with the ability to transcend space, time, physical and perceptual barriers through the use of simple affordable computing devices and connective technologies. These tools and capabilities should be implemented with a goal of promoting a change in classroom instructional practice which better reflects current and future practice in the workplace and higher education, as well as a better reflection of research-based classroom best practices.

Research Rationale for how this change will help kids:

There are a variety of instructional goals and outcomes under this recommendations umbrella:

- **Higher education and other content/collaboration partners:** Through connection tools, collaboration with higher education departments, teachers, museums, programs, and other content providers (e.g., College of Engineering, 2005) can be facilitated.
- **Computer ratios:** In the face of the increasingly importance of universal access to online information in the world outside of P-12 education, it is critical for students to have continuous access to devices for just-in-time use.
- Research has shown positive results from schools in which there is a one-to-one ratio of students to computers. (Apple Computer, 2005).

In their analysis of the impact of one-to-one computing on student achievement, Gulek & Demirtas (2005) stated:

> "Past research suggests that compared to their non-laptop counterparts, students in classrooms that provide all students with their own laptops spend more time involved in collaborative work, participate in more project-based instruction, produce writing of higher quality and greater length, gain increased access to information, improve research analysis skills, and spend more time doing homework on computers. Research has also shown that these students direct their own learning, report a greater reliance on active learning strategies, readily engage in problem solving and critical thinking, and consistently show deeper and more flexible uses of technology than students without individual laptops. The study presented here examined the impact of participation in a laptop program on student achievement. A total of 259 middle school students were followed via cohorts. The data collection measures included students' overall cumulative grade point averages (GPAs), end-of-course grades, writing test scores, and state-mandated norm- and criterion-referenced standardized test scores. The baseline data for all measures showed that there was no statistically significant difference in English language arts, mathematics, writing, and overall grade point average achievement between laptop and non-laptop students prior to enrollment in the program. However, laptop students showed significantly higher achievement in nearly all measures after one year in the program. Cross-sectional analyses in Year 2 and Year 3 concurred with the results from the Year 1. Longitudinal analysis also proved to be an independent verification of the substantial impact of laptop use on student learning outcomes."

Access to courses: With the greatly expanding availability of distance learning opportunities, and with a continuingly increasing body of literature promoting them as viable alternatives to face-to-face instruction (see Allen *et al.*, 2002; Bernard *et al.*, 2003; Blomeyer, 2002; Education, 2000), we can no longer be content with a school's limited ability to staff and offer AP and elective courses, especially at the secondary school level ("Advanced placement incentive program grants", 2003, "Senate bill 74", 2002).

Implementation Steps for Recommendation # 8	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
8A. Provide a 1-1 ratio of student to computing/communications devices using affordable and sustainable hardware, for continuous use throughout a student's school day, and entire school experience. This device should provide… • Managed communication (email, threaded discussion) • Wireless access to the Internet and WAN • Portability. • Access to basic productivity tools, such as word processing.	Chief Financial Officer, Director of Education Technology, Coordinator of Instructional Technology, Supervisor of Systems Support, District TRTs		7/06	ongoing
8B. Provide for an expansion of across-distance course offering options for students, especially at the secondary level, utilizing virtual online schools as well as video-linked classroom offerings in real time.	Coordinator of Instructional Technology, District TRTs		9/05	ongoing
8C. Provide and support e-communications initiatives such as blogs, forums, and other interactive tools, with a goal of providing consistent and useable tools for student-student, student-teacher, and student-adult collaboration and mentored instruction which transcends the constraints of the physical classroom and class meeting timeframes	Coordinator of Instructional Technology, District TRTs		9/05	ongoing
8D. Enhance the classroom through the use of virtual field trips and other Internet-connection-supported collaborative experiences using real-time Video-over-IP connections to outside instructional and content delivery agents, such as Universities, museums, and research facilities.	Coordinator of Instructional Technology, District TRTs		9/06	ongoing

Implementation Steps for Recommendation # 8	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
8E. Use computing devices and appropriate online resources to overcome barriers to learning and differences in learning styles, including language disabilities and other student learning challenges.	Coordinator of Instructional Technology, District TRTs		9/06	ongoing

Group Recommendation Number: 9 - Data Sharing

Specific Recommendation Provide for the full integration of all data sources through a district initiative of data sharing and mining through the existing systems which can be used to directly impact and support instruction, remediation, and enrichment. The goal should be to provide instructors, administrators, district staff, parents, and designated stakeholders access to as complete a picture of educational performance as possible, from the individual student to entire classes, programs, grant initiatives, schools, and the district at a whole.

Research Rationale for how this change will help kids:

It is critical that all data relevant to student performance be available directly to teachers, in a format which is useful and "just in time" for instructional design and classroom practice (Ploeg & Thum, 2004). "Data-driven instruction" is a catch-word these days, and is the supposed driving force behind many education initiatives such as No Child Left Behind (Education, 2002), but to have an impact on student achievement, the data required by this initiative must be available to those in the classroom (Ploeg & Thum, 2004).

The full integration of all data sources, including fiscal and staffing data as well as assessment and other student-related data, will provide a fuller data-driven picture of classrooms, schools, and programs. This will greatly facilitate the selection and improvement of school and district instructional initiatives, grants, software, and other instructional resources and programs – both in terms of student performance, and "return on investment."

Implementation Steps for Recommendation # 9	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
9A. Contract for the design and implementation of a data-sharing system for the central coordination and display of all relevant district data sources. For instance, the system could be used to analyze district expenditures and determine if funds are budgeted in areas where they have the greatest impact on student achievement and efficient operations.	Director of Student Achievement, Chief Financial Officer, Coordinator of Instructional Technology, District Technology Resource Teachers	Sharepoint or other content management suite	1/06	ongoing
9B. Provide every teacher and instructional leader with immediate electronic access to detailed student data to be used in adjusting instruction to meet individual student needs. Data should be both current and longitudinal. Data will include but not be limited to test scores, progress on criterion referenced measures, and attendance.	Director of Student Achievement, Chief Financial Officer, Coordinator of Instructional Technology, District Technology Resource Teachers	Sharepoint or similar capability	1/06	ongoing
9C. Build data access and delivery capability and infrastructure with a goal of being able to provide full data-driven instruction for the teacher in real time, using 1-1 wireless student computing devices, as well as data coordination between assessment tools. This data access should be scalable from individual student to class, school, and district totals, with disagregation on a variety of criteria.	Director of Student Achievement, Chief Financial Officer, Coordinator of Instructional Technology, District Technology Resource Teachers		1/06	ongoing

Group Recommendation Number: 10 - Community Involvement and Sustainability

Specific Recommendation:

Provide adequate funding to support other 2020 recommendations and basic technology operations. Technology should be a basic operational component in the district and school budgets.

Research Rationale for how this change will help kids:

- Action step two of the National Education Technology Plan (2004) is "Consider Innovative Budgeting." Recommendations from the plan are:

- Determine the total costs for technology as a percentage of total spending.
- Consider a systemic restructuring of budgets to realize efficiencies, cost savings and reallocation. This can include reallocations in expenditures on textbooks, instructional supplies, space and computer labs.
- Consider leasing with 3-5 year refresh cycles.
- Create a technology innovation fund to carry funds over yearly budget cycles.

- According to "Technology Counts 2005" (Education Week, May 2005), "over the past five years, Kentucky has gone from having one of the most modern computing environments in its schools to one of the least up-to-date." This special issue examined comparative technology funding in all of the states and concluded that Kentucky schools have been "underfunded by $50 million a year for the past five years." It was also reported that Kentucky schools are underfunded in terms of technology staff and should have 3 to 5 times the technology staff in order to be in line with comparable organizations.
- According to "Technology Counts" (2005), the average student to instructional computer ratio in Kentucky in 2004 was 3.7 to 1. The student to instructional computer ratio in Fayette County is 5 to 1.
- An informal survey in May 2005 found that 6 out of the 37 responding districts in Kentucky assess some sort of technology fee. Those range from $1 to $25 per student, with an average of $10.
- According to an August 2005 article in eSchool News, Michigan's "Freedom to Learn" program which provides laptop computers for 20,000 middle school students and 1,200 teachers has resulted in "marked improvements in standardized test scores in reading, writing, science, and math. http://www.eschoolnews.com/news/showStory.cfm?ArticleID=5780

The U.S. Department of Education (Pelavin Research Institute, 1997) issued recommendations for funding school technology. Among those recommendations were "convert to zero-based budgeting, which requires a critical reexamination of all programs each year" and "specify a fixed percent of the budget for instructional expenses to be set aside for educational technology and its supporting programs."

The TSI survey (ISTE, 2005) recommends a 3 to 5 year replacement cycle for equipment, through leasing or purchase and replacement. Equipment should be surplussed after its usable life, even if the equipment may still work. Equipment that works may not necessarily be efficient equipment. For example, if a teacher is using a program for a group presentation and the class has to wait five minutes for the program to load due to the slowness of an aging computer, that equipment is no longer efficient and the inefficiency has a negative impact on instruction. TSI also recommends standardizing on a single brand of computers to create support efficiencies.

Implementation Steps for Recommendation # 10	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
10A. Provide adequate funding to support other 2020 recommendations and basic technology operations.	Director of Education Technology	Board of Education	11/1/05	ongoing

Implementation Steps for Recommendation # 10	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
10B. Establish a line item percentage of total school budgets dedicated to technology. Technology should be a basic operational component in the district and school budgets.	Director of Education Technology	Board of Education	11/1/05	ongoing
10C. Explore collaboration with nonprofit technical centers, including faith-based	Coordinator of Instructional Technology		11/1/05	ongoing
10D. Explore creation of school-based technology booster groups	School Technology Coordinators		1/1/06	ongoing
10E. Consider alternative funding initiatives such as "box tops for education"	School Technology Coordinators		1/1/06	ongoing
10F. Expect adoption of new technology to reduce current/future expenses that could be applied to other technology needs (for instance e-books could eliminate textbooks)	Director of Education Technology		1/1/06	ongoing
10G. Solicit company sponsorship in exchange for advertising/goodwill.	Director of Education Technology		11/1/05	ongoing
10H. Create a "third year tax" that happens every third year to specifically fund technology – could be a small percentage	Board of Education		1/1/06	ongoing
10I. Establish an on-going workgroup to determine efficiencies that can be realized in all areas of the district through the use of technology. For example, the district may be able to save money by converting textbooks, library materials, and other print documents to digital format.	Director of Education Technology	Staff with input from Kentucky Department of Education and community groups	12/1/05	ongoing
10J. Consider instituting a technology fee for students. This has been done in other school districts in the state and at colleges. One possible approach could be to require "lab fees" from each student – encourage parents to work at outside organization that will pay this fee in return for work performed (i.e. Keeneland or Rupp Arena)	Director of Education Technology		8/1/06	ongoing

Implementation Steps for Recommendation # 10	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
10K. Through the Fayette Education Foundation, enable individuals to make tax-deductible contributions that would support technology.	Superintendent	Fayette Education Foundation (http://www.fayetteeducationfoundation.org/)	12/1/05	ongoing
10L. Pursue additional funds through grants. Maintain an updated list of funding priorities along with supporting data. The list would be used to decide which grants to pursue.	Coordinator of Instructional Technology	Priorities identified by schools and matched to state, federal, and other funding sources.	Begin priority list 11/1/05	ongoing
10M. Consider leasing computers – creates known budget amount and reduces maintenance, end lease product available to students.	Director of Education Technology		1/1/06	ongoing

References

2001-2006 master plan for education technology. (2005). Retrieved October 10, 2005, from http://www.education.ky.gov/KDE/Administrative+Resources/Technology/Master+Plan/2001-2006+Master+Plan+Update+.htm?IMAGE=Search

Advanced placement incentive program grants. (2003). Retrieved September 24, 2003, from http://www.ed.gov/programs/apincent/index.html?exp=0

Allen, M., Bourhis, J., Burrell, N., & Mabry, E. (2002). Comparing student satisfaction with distance education to traditional classrooms in higher education: A meta-analysis. *American Journal of Distance Education, 16*(2), 83-97.

Apple Computer (2005). *Apple 1 to 1 Learning.* Available online at http://www.apple.com/education/k12/onetoone/

Bain, A., & Ross, K. (2000). *School reengineering and SAT-1 performance: A case study*. International Journal of Education Reform, 9(2), pp. 148-153

Bernard, R. M., Lou, Y., & Abrami, P. C. (2003). *How does distance education compare to classroom instruction? A meta-analysis of the empirical literature.* Paper presented at the Association for Educational Communications and Technology Annual Conference, Anaheim.

Barron, B., Schwartz, D., Vye, N., Moore, A., Petrosino, A., Zech, L., Bransford, J., & Cognition and Technology Group at Vanderbilt. (1998). *Doing with understanding: Lessons from research on problem- and project-based learning*. Journal of the Learning Sciences, 7, 271-312

Bernard, R. M., Lou, Y., & Abrami, P. C. (2003). *How does distance education compare to classroom instruction? A meta-analysis of the empirical literature.* Paper presented at the Association for Educational Communications and Technology Annual Conference, Anaheim.

Blomeyer, R. (2002, April 2002). Virtual schools and e-learning in k-12 environments: Emerging policy and practice. *Policy Issues* 11. Retrieved October 10, 2005, from http://www.ncrel.org/policy/pubs/pdfs/pivol11.pdf

Center for Online Professional Education (2000), Leadership and the New Technologies, Education Development Center, 55 Chapel St., Newton, MA 02458

Center for Research on Information Technology and Organizations (1998), Teaching, Learning and Computing: 1998: Computer

Technology and Instructional Reform, University of California at Irvine. Available online at: http://www.crito.uci.edu/tlc/html/tlc_home.html

Cohen, D K., Hill, H. C. (2001) Learning Policy: When State Education Reform Works. New Haven, CT: Yale University Press

College of Engineering, U. o. K. (2005). The metaverse. Retrieved October 10, 2005, from http://www.metaverselab.org

Comprehensive District Improvement Plan for 2004-2006 (2004). Fayette County Public Schools, Lexington, KY.

Consolidated Plan for 2000-2002 (2000). Fayette County Public Schools, Lexington, KY.

Consolidated Plan for 2002-2004 (2002). Fayette County Public Schools, Lexington, KY.

District Technology Assessment (2005). Fayette County Public Schools, Lexington, KY.

Dunwoodie, B. (2005, Wednesday, Mar 16 2005). Humans found to be generally unproductive. *Industry News* Retrieved October 12, 2005

Education, U. D. o. (2002). No child left behind. Retrieved October 10, 2005, from http://www.ed.gov/nclb/

eSchool News Staff and Wire Reports. (2005). Michigan Laptop Program Shows Early Success. *eSchool News, July 11, 2005.* Available online at: http://www.eschoolnews.com/news/showStory.cfm?ArticleID=5780

Fayette County Public Schools (2005). District Technology Assessment. Available online at: http://www.fcps.net/edtech/DTA-05-final.pdf

Fox, E. (2005). Tracking U.S. Trends. *Education Week, 24(35).* Available online at: http://www.edweek.org/ew/toc/2005/05/05.

Garet, M. S., Porter, A. C., Desimone, L. (2001). "What Makes Professional Development Effective? Results from a National Sample of Teachers." American Educational Research Journal, Vol. 38, No.4 (winter), pp 915-945

Granger, C., Morbey, M.L., Lotherington, H., Owston, R., & Wideman, H. (2002). *Canada: Factors Contributing to Teachers' Successful Implementation of Information Technology* Presented at the Annual Meeting of the American Educational Research Association; April 2002. Available online at: http://www.yorku.ca/irlt/reports/aerapaper.htm

Grunwald, P. & Associates, & Rockman (2002). *Are we there yet?* Alexandria, VA: National School Board Foundation. Retrieved February 17, 2003, from http://www.nsbf.org/thereyet/fulltext.htm.

Gulek, J. C. & Demirtas, H. (2005). Learning with technology: The impact of laptop use on student achievement. *Journal of Technology, Learning, and Assessment, 3*(2). Available from http://www.jtla.org

Haney, W., Madaus, G., & Lyons, R. (1993). *The Fractured Marketplace for Standardized Testing*. Boston, MA: Kluwer Academic Publishers.

Hodari, A.K. & Wenger, J.W. (2002). *Technology in Schools: Evaluation of Kentucky's Student Technology Leadership Program*. Alexandria, VA: Appalachian Technology in Education Consortium. Available from: http://www.the-atec.org/library/atec-stlp-3.pdf

Honey, M., Culp, K. M., & Carrigg, F. (1999). *Perspectives on technology and education research: Lessons from the past and present.* New York: Center for Children and Technology. Retrieved March 28, 2002, from http://www2.edc.org/CCT/index.asp.

International Society for Technology in Education (ISTE). (2005) *Technology Support Index (TSI)*, Avialable online at: http://tsi.iste.org/

Kent, P. (1995). *Why we should be using "worldware" in computer-based learning.* London, England: Imperial College. Available online at: http://www.metric.ma.ic.ac.uk/articles/Worldware.html

Kentucky Department of Education (1997). Kentucky CyberKeys: A P-9 Guide to Keyboarding. Frankfort, KY: Kentucky Department of Education.

Kentucky Department of Education (March 12, 2005). Student Technology Standards. Available online at: http://www.education.ky.gov/KDE/Instructional+Resources/Technology/Student+Initiatives/Student+Technology+Standards/default.htm.

Marzano, R. J. (1998). A theory-based meta-analysis of research on instruction. Retrieved October 10, 2005

Means, B., & Olson, K. (1997). Technology and education reform. Office of Educational Research and Improvement, Contract No. RP91-172010. Washington, DC: U.S. Department of Education.

Metzger, S. (contributing writer) (2005). State of the States. *Education Week, 24(35).* Available online at: http://www.edweek.org/ew/toc/2005/05/05

Meyer, B. (1975). The organization of prose and its effects on memory. Amsterdam: North Holland Press

Pelavin Research Institute, Investing in School Technology: Strategies to Meet the Funding Challenge, Prepared for the U.S. Department of Education, Washington, D.C., 1997. Available online at: http://www.ed.gov/pubs/techinvest/title.html.

Ploeg, A. v. d., & Thum, Y. M. (2004, December 2004). Finding additional value in new accountability systems. *NCREL - Educational Policy* Retrieved October 10, 2005, from http://www.ncrel.org/policy/pubs/pdfs/value.pdf

Ronnkvist, A.M., Dexter, S.L., & Anderson, R.E. (2000): *Technology Support: Its Depth, Breadth and Impact in America's Schools* A research project of the Center for Research on Information Technology and Organizations, University of California, Irvine

Russell, M. (1999). Testing Writing on Computers: A Follow-up Study Comparing Performance on Computer and on Paper. *Educational Policy Analysis Archives, 7*(20). Available online: http://epaa.asu.edu/epaa/v7n20/.

Russell, M. & Haney, W. (2000). Bridging the Gap between Testing and Technology in Schools. *Educational Policy Analysis Archives, 8*(19). Available online: http://epaa.asu.edu/epaa/v8n19/

Schacter, J. (1999). The Impact of education technology on student achievement. Santa Monica, CA: Milken Exchange in Education Technology

Senate bill 74. (2002). Retrieved September 24, 2003, from http://lrc.ky.gov/recarch/02rs/SB74/bill.doc

U.S. Department of Education, Office of Educational Technology, Toward A New Golden Age in American Education: How the Internet, the Law and Today's Students Are Revolutionizing Expectations, Washington, D.C., 2004

Valdez, G. & McNabb, M. (1999). Computer-based technology and learning: Evolving uses and expectations. Oakbrook, IL: North Central Regional Educational Laboratory

Walker, L., Rockman, S., & Chessler, M. (2000). *A more complex picture: Laptop use and impact in the context of changing home and school access. The third in a series of research studies on* Microsoft's Anytime Anywhere Learning Program. San Francisco, CA: Rockman, et al. Retrieved February 13, 2003,from http://rockman.com/projects/laptop/laptop3exec.htm.

Wenglinsky, H. (1998). Does it compute? The relationship between educational technology and student achievement in mathematics. Princeton, NJ: Policy Information Center, Educational Testing Service

Appendix 1
Commonalities with Other 2020 Groups

Technology is pervasive in the school district so it has an impact on and is impacted by every other area. The chart below shows areas of strongest relationship. These are preliminary, and may need to be updated when all of the groups' final reports are released.

Key: ○ = moderate relationship ● = strong relationship

Groups	Technology Recommendations									
	1. Software	**2. Hardware & Infrastructure**	**3. Professional Development & Student Involvement**	**4. Portability & Access**	**5. Standards & Assessment**	**6. Physical Infrastrure**	**7. Data & Communication Tools**	**8. Ubiquitous Access**	**9. Data Sharing**	**10. Community Involvement & Sustainability**
2020 Arts	●	●	●	○	●	●	●	○	○	○
Community Partnerships & Mentoring	○	●	●	○	○	●	●	●	●	●
Connecting to the World	○	●	●	●	●	●	●	●	○	○
Critical Thinking, Chess, & Strategic Games	●	●	●	●	○	●	●	●	○	○
Early Childhood Experiences	●	●	●	○	●	●	●	○	●	●
Family Involvement	●	●	●	●	●	○	●	●	●	●
Financial Literacy	●	●	●	○	●	●	●	○	●	●
High School Reform	●	●	●	●	●	●	●	●	●	●
Innovative Options	●	●	●	●	●	●	●	●	●	●
Literacy	●	●	●	●	●	●	●	●	●	○
Mental Health & Well-Being	●	●	○	○	○	○	●	○	●	○
Middle School Reform	●	●	●	●	●	●	●	●	●	●
Middle to High School Transition	○	●	○	●	○	●	●	○	●	○
Music	●	●	●	○	○	●	●	○	○	○
Numeracy	●	●	●	●	●	●	●	●	●	
Physical Health & Well-Being	●	●	●	○	○	○	●	○	○	●
School Safety & Alternative Placements	●	●	●	●	●	●	●	●	●	●
Science & Technical Education	●	●	●	●	●	●	●	●	●	●
Student Leadership & Service Learning	○	○	●	●	●	○	●	●	○	●
World Languages	●	●	●	●	○	●	●	●	○	●

Appendix 2
Commonalities with One Community, One Voice

Technology supports all of the functions of the school district in one way or another. Of the 89 strategies proposed in the One Community, One Voice report, technology addresses all strategies indirectly and it addresses the following strategies most directly:

OCOV Strategy	How Addressed by Technology
World Class Standards and Accountability	
1. Use KCCT data as a guide to measure progress.	Data mining and sharing of data electronically will help accomplish this strategy more efficiently.
2. Collect and monitor data that indicated equity opportunity for all students.	Data can be disaggregated electronically.
4. Use academic and opportunity data to identify and recognize schools and teachers that are closing gaps…	District Internet access can be used to research the successes of schools and organizations. Data from those schools and organizations can be accumulated and analyzed using data analysis capabilities.
6. Improve communication links between elementary, middle, and high schools.	Technology enhances communication in a number of ways, such as electronic forums, email, and data sharing capabilities proposed in this 2020 document.
7. Assure strong reading skills…	There is strong research indicating the efficacy of computer-enhanced reading programs such as Read 180, Earobics, Headsprout, and Reading for Meaning.
8. Assure that all middle schools prepare all students to succeed in algebra.	Computer-enhanced programs such as Larson's Prealgebra can help prepare students.
9. Develop strategies for continuous assessment in the classroom…	The 2020 recommendations for data sharing address this need directly, and provide for an efficient means of monitoring and facilitating the interpretation of continuous assessment.
10. Require all middle and high schools to effectively implement IGPs.	The district initiated the first electronic IGP in the state last year.
11. Encourage schools to pilot research-based strategies to improve student achievement.	The district is strong in promoting research-based software. The 2020 recommendation for a software review process will strengthen this even further.

OCOV Strategy	How Addressed by Technology
Teacher Subcommittee	
1. Initiate the use of a Personnel Perceiver Interview approach (from www.gallup.com)	The Teacher Insight Interview associated with Personnel Perceiver is administered online.
3. … identify "master teachers"…	Data mining proposed in this 2020 document would facilitate identifying teachers who are most effective in promoting student achievement.
8. …undertake the task of aligning the curriculum…	The district's curriculum map is available electronically via the district website.
Early Childhood Education	
1. Early start center…	Research has identified a number of programs that are effective supplements to good early childhood education, such as Headsprout and Earobics.
3. Provide all students and teachers with extra help needed for all student to be proficient in literacy (reading, writing, and math) by the end of the Primary Program.	Same as above. Also, the district is considering programs such as FASTT Math to boost fluency in math skills in primary. This 2020 plan addresses keyboarding at the late primary level as a prerequisite to effective computer based writing.
Exceptional and Diverse Learners	
3. …data collection and interpretation of indicators form from the Education Development Center, Inc….	Data may be collected and analyzed electronically.
6. …annual review as required by the Individuals with Disabilities Education Act…	Electronic forms are used as part of the annual review process.
8. …reduce caseloads for special education teachers…	Assistive technology can reduce the workload of some teachers by providing another means for individualized instruction. For example, Read & Write Gold software may be used in place of "reader" who would be assigned to a student.
Parent/Family Involvement	
3. Create a public information campaign.	The district and school websites can serve as a component of the campaign. Many parents have access to email, and that mode of communication may be used to promote better home/school communication. Many parents may check their children's grades using the district's STI system.

OCOV Strategy	How Addressed by Technology
Leadership	
3. Make direct observation a routine practice in the workplace.	Principals now have access to an electronic classroom observation tool, provided by the Kentucky Department of Education. Principals use handheld computing devices during the observation and then download results to their desktop computer for later analysis and consultation with teachers.
5. …professional development for principals…	Much of the administrative training is now provided online via providers such as Kentucky Virtual High School, Encyclomedia, and videoconferencing resources.
School-Based Decision Making Councils	
8. Ensure that each council follows the requirement to review assessment data…	These data are available and can be best analyzed electronically.
Finance	
5. Provide specialized professional development.	Technology is used to deliver some professional development. For example, Kentucky Virtual High School and Encyclomedia offer a number of training options. Also, the district maintains a webpage listing and registration program for district-wide professional development. It included email reminders and an electronic evaluation which is emailed to the teacher the day after the training.