APPENDIX B

INTEGRATING TECHNOLOGY IN SPECIFIC PROGRAM AREAS

Science

As teachers plan instruction related to their science program, technology should be incorporated into their lessons. These lessons, ranging from Kindergarten through grade 12, are based on the 5 E model: engagement, exploration, explanation, extension and evaluation. Technology resources can be incorporated as another tool of the student scientist during any portion of a lesson where it may be logically applied and developmentally appropriate. The science classroom experience provides an opportunity for students to use the technology skills they have developed in other classrooms.

In Maryland K-8 Outcomes for Science, the skills and processes are identified. A student should use these skills and processes within the context of a science lesson to develop an understanding of the various science concepts. Technology can support a variety of learning experiences in all of these Outcomes, while laying the foundation for knowledge and skills to be developed in the high school science program.

In the High School Core Learning Goals for science, each of the concept areas – Earth/Space Science, Biology, Chemistry and Physics – is connected to Goal 1 "Skills and Processes" and contains specific references to the technology associated with that area. The technology-related Expectations and Indicators in Goal 1 include the following:

The student will:

- select appropriate instruments and materials to conduct an investigation.
- develop skills in using laboratory and field equipment to perform investigative techniques.
- learn the use of new instruments and equipment by following instructions in a manual or from oral direction.
- analyze outputs generated by technology such as spreadsheet, graphing and database programs, probe ware on computers and/or graphing calculators.
- use models and/or computer simulations to extend his/her understandings of scientific concepts.
- use computers and/or graphing calculators to perform calculations for tables, graphs and spreadsheets.
- use computers and/or graphing calculators to produce the visuals that will be used for communicating results.

Instructional Examples:

The study of local streams is conducted across all grades and instructional settings. Students in classrooms and Outdoor Education Centers combine the excitement of outdoor exploration, authentic data collection, and scientific inquiry with the use of sophisticated technologies. Using laptop computers students make onsite observations at the stream and record them for comparison over time. Digital images of the site record changes in biodiversity and erosion. These images also support student writing to inform or persuade. Using probeware, data is collected on temperature, stream chemistry, and the weather conditions. This data is added to past stream data in spreadsheets to analyze the stream's condition through graphing tools. This data is then compared with the online stream data collected by the National Oceanic and Atmospheric Administration (NOAA). The students record the macro-invertebrates that are found in their stream and take digital images of them for later identification confirmation. If they have difficulty identifying of the macro-invertebrates the scientists at the Department of Natural Resources are available for consultation. The stream observations and data is then shared with other classrooms to obtain a better understanding of our local, state, and national streams. These studies are valuable when considering the impact of impervious surfaces, sediment and chemical runoff, heat island effect, and chemical dumping in local streams.

The virtual frog web site and other virtual dissection sites allow students to manipulate a model and collect data about a particular subject without ever actually touching a real frog. See website: http://www-itg.lbl.gov/ITG.hm.pg.docs/Whole.Frog/Whole.Frog.html

In the physics classroom students often incorporate simulations into their learning experience. As students explore the concepts of physics in amusement parks and then assume different roles in researching and developing a proposal for a new amusement park. When investigating the first law of thermodynamics and conservation of energy, students use simulation software to evaluate the efficiency of heat engines they have constructed and attempt modifications to improve the efficiency. Students then compare their models with each other, analyzing different factors to determine which is the most economical design.

Students in elementary, middle and high school Earth Science classes are working on the Chesapeake Bay from Space program in partnership with the Maryland Space Grant Consortium, NASA, and Towson University. They conduct studies on the impact of impervious surfaces in the Chesapeake Bay region. This study includes the use of Global Positioning Satellite (GPS) units to ground truth impervious surfaces and to learn map reading skills. Students then infuse the study of LandSat images using NIH Image a free software developed through the National Institutes of Health. They compare change over time in both current images and images from 1973. Geographic Information Systems (GIS) software, an industry standard, is then used to facilitate to analyze the data collected. Information is then shared in a collaboratively across the state.
Chesapeake Bay from Space
http://chesapeake.towson.edu

English Language Arts

English Language Arts (ELA) education has traditionally helped students master the listening, speaking, reading and writing skills requisite for success and active participation in community life. The 1986 English Language Arts Curricular Framework notes that ELA education provides "the means for universal basic literacy." In today's information-rich society, however, "universal basic literacy" needs redefinition in light of the rapid development of new information and communication technologies. From the use of conventional printed texts to electronic hypertext on the World Wide Web, from the simple graphics of posters and charts to the dynamic visual language of film, learners engage as creators and receivers of messages. Knowledgeable, reflective, critical and creative participants in contemporary life need to gain access to, respond to, and make strategic use of a whole spectrum of technology and media.

Each classroom should have sufficient technologies available for students to routinely use them for one of the following learning activities related to the English Language Arts Core Learning Goals and indicators:

- Composing and editing original texts (word processing).
- Researching (on-line services and CD ROM catalogues).
- Prewriting, drafting, revising, editing and publishing original texts (word processing with appropriate tools, such as spell checkers, dictionary/thesaurus and grammar check).
- Preparing and presenting multimedia presentations and oral texts.
- Locating, retrieving, evaluating and using information from various sources.
- Responding to print and non-print texts.

Second-language programs have many of the same goals. English as a Second Language (ESL) programs provide support and transitional services to linguistically-diverse students who need to improve listening, speaking, reading and writing in their new language, English, in order to succeed in the culture of American schools. ESL programs translate to the above-listed English Language Arts Core Learning Goals. Similarly, foreign language programs for English-speaking students provide the means to develop insight into the nature of language and culture, to connect with other disciplines and to communicate in languages other than English. An important goal of all second-language education is to enable students to participate in multilingual communities at home and around the world. Communication technologies provide such access to the world and its languages.

Instructional Examples:

Students use electronic journals to support the writing process. Students become engaged in collecting, saving and displaying samples of their work using a word processor, camera, scanner and software programs. They plan, organize, and save their work using a storyboard approach. With these tools, students are able to computerize work samples and record personal reflections upon those samples each grading period.

The writing skills of students may increase when they have a meaningful audience for their work, which can be found by using e-mail and the Internet. E-mail can be accessed to send letters to businesses and politicians. The Ask an Expert web site can open doors for students to consult with real experts in numerous disciplines on real-life problems and issues. E-mail can also be utilized for peer review and sharing. It is very motivating for students to share their work with other teachers, students, and members of the learning community. The Internet also hosts multiple resources for publishing student work. Students can easily contribute poetry, fiction and non-fiction for publication to a potential worldwide audience.

Acquiring research skills is an essential habit of mind for student success and the Internet and electronic encyclopedias are valuable resources in conducting research. The user can access a wealth of information about nearly any topic imaginable. Much of the information comes from primary sources, a store of knowledge nearly impossible to tap effectively until the advent of the Internet. Students take notes using a word processor as they read the actual diaries of Howard Carter or Elie Wiesel, or as they study ancient cultures and compare them to modern civilization. They utilize valuable Internet resources about life in Egypt, examining hieroglyphics, and reading first-hand accounts by Howard Carter, the archaeologist who discovered the tomb of King Tut. They can compare ancient maps with modern maps. They find and prepare authentic recipes. Throughout this process, students create a multimedia presentation (using Kid Pix, Hyperstudio or PowerPoint) to describe what they have found.

Reading across disciplines and providing differentiated reading material is critical. The Internet provides reading matter such as diaries and other first-hand accounts of important events, discussions of scientific findings and even full copies of important literary works. Students access full text versions of thousands of books on the Project Gutenberg site. It's purpose is to provide full access to the great literary works, including works by Shakespeare, Poe, and Melville, as well as lighter classics like Alice in Wonderland. Additionally, full text versions of important reference books are also provided. http://promo.net/pg/

In reading for literary experience, students in high school study Amy Tan's Joy Luck Club. One group of students uses the Internet to conduct a virtual tour of locations that form the setting of the novel. Students access several Internet sites containing information related to the geography of San Francisco, exploring not only historical and current maps but also real-time and archival photographs. To record and communicate their experiences while "on tour" to fellow class members, students employ presentation

software. An extension to this lesson might include employing desktop publishing software to publish a newspaper, travelogue, or brochure or incorporating the presentations into a class website that can be viewed by other teachers and students, as well as parents.

Mathematics

In the report, Keys to Math Success, released by the Maryland Mathematics Commission in June 2001, there are two recommendations that specifically address technology. They are:

- Ensure that all mathematics students have the appropriate access to calculators, computers, and Internet connections for class work and homework. Teachers shall incorporate the use of such technology into the delivery of mathematics instruction.
- Require that candidates for initial and permanent certification as school administrators and (K-16) mathematics teachers demonstrate computer, calculator, and Internet skills and have the ability and willingness to incorporate technology/multimedia into mathematics instruction.

The vision of the commission is to provide all students and teachers with the opportunity to use technology to support and extend student learning. Students must learn the power of technology in order to deal with real-life situations. They need to know when and how technology will improve their ability to solve problems.

What we teach, how we teach, and the means by which we evaluate the relative success of that teaching and learning are inextricably influenced by technology. Skills and strategies previously not emphasized now need to be stressed (e.g., the increased need to recognize when computation and estimation are most appropriately done using mental, paper and pencil, and/or technology-supported methods, as well as the ability to judge the feasibility of solutions to problems). Instructional use of technology allows teachers to capitalize on the power of visualization and the connections between and among graphic, numeric and symbolic representations (such as when applying the properties of one-, two-, and three-dimensional geometric figures to represent, investigate, model, analyze, solve and evaluate solutions to problems).

Teaching mathematics as an investigative, exploratory subject requires the use of technology. Projects and group explorations that use technology may be added to instructional lessons to help students make connections among the different areas of mathematics as well as content from other disciplines. Technological research tools such as the Internet enable students to collect real-world, up-to-the-minute data, analyze the data, and then to share their findings and conclusions with others.

Specifically, students are expected to:

- analyze a wide variety of patterns and functional relationships using the language of mathematics and appropriate technology (such as graphing calculators, spreadsheets and computer software).
- model and interpret real-world situations, using the language of mathematics and appropriate technology (such as graphing calculators, CBLs, spreadsheets and computer software).
- represent and analyze two- and three-dimensional figures using tools and technology (such as interactive software and graphing calculators).
- apply geometric properties and relationships to solve problems using tools and technology (such as interactive software and graphing calculators).
- apply concepts of measurement using tools and technology (such as interactive software and graphing calculators).
- demonstrate the ability to apply probability and statistical methods for representing and interpreting data and communication results, using technology when needed (using graphing calculators, spreadsheets and computer software).
- use transformations to move figures, create designs and/or demonstarte geometric properties.

Instructional Examples:

The Maryland Virtual High School in Science and Mathematics (MVHS), funded under a National Science Foundation Research in Educational Policy and Practice grant, creates and uses dynamic computer modeling to help students reach the expectations of national and state standards in science and mathematics. Student in MVHS schools have collaborated to pinpoint the epicenter of a fictitious earthquake, used the Internet to share data comparing local water quality, and chatted online with Governor Glendening about educational uses of technology. The Internet-based virtual school uses the CoreModels curriculum of graphic modeling and simulation to encourage student investigations, predictions and hypothesis-testing. It also enables teachers to continually improve math and science instruction through peer collaboration.

In high school, students apply probability and statistical methods for representing and interpreting data and communicating results. They examine the power of natural selection and the relationships between animals and their environment. Teachers participating in the Maryland Technology Consortium (MTC) Fall Institute designed activities for students to look for reasons for bird migration. They complete a simulation about predatory effects on the goose population and collect data supporting their findings. They use this data to create a "Null Hypothesis" chart in a spreadsheet to see if their findings are either correct or unrelated to the actual causes of migration. See http://www.mcps.k12.md.us/mtlt/institute99/index.html for more information and for access to more than 20 complete science and mathematics lessons using technology.

Teachers use a variety of affordable software packages to present mathematics problems in graphic form in which students can actually see the ideas at work. Students in elementary and middle school use Data Explorer to set up and conduct surveys, collect

data from the Internet, graph and analyze data, and decide which graph best represents their data. In high school, rather than simply telling a class that the limit of the sine (1/x) as x approaches 0 does not exist since the function oscillates as x approaches zero, a calculus teacher instead enters the function on a Graphing Calculator program. A vivid onscreen image displays the behavior of this function, using what seems like animation. Immediately, the students understand why the sine limit fails to exist.

In middle school, students work in cooperative groups to investigate the relationship between degrees Fahrenheit and degrees Celsius. They use the Calculator-based laboratory (CBL), temperature probes, and a graphing calculator. They measure ten different temperature reading in both degrees Celsius and Fahrenheit for a cup of water and a cup of ice. Students then graph the results on the graphing calculator. Students use the graphs and the room temperature in degrees Fahrenheit to determine the temperature of the room in degrees Celsius.

Social Studies

Access to computers with Internet and multimedia capability in the classroom, as well as the library media center, provides students with appropriate current materials, including economic and geographic data, necessary to reach the critical thinking levels called for in the Expectations and Indicators of the Social Studies Core Learning Goals. Students can learn to research historical and current situations and events, as well as answers to questions or background on issues. They can also become aware of research methodologies that will assist them in study, work and other informational needs after graduation. These capabilities would also enhance students' participation in interactive on-line field trips and experiences, such as the Pride of Baltimore program, the Whitbred Race and MayaQuest. Multimedia capability is important not only because it allows teachers to address a variety of learning styles, but also because it provides a vehicle for students, through development of projects and presentation, to demonstrate proficiency in Core Learning Goals and Skills for Success.

The student will:

- construct a historical argument based on research and interpretation.
- create and use visual and mathematical data presented in graphic organizers to gain comprehension in a field of social studies.
- draw upon visual, literary and musical sources to gain historical comprehension.
- use library media resources to access, organize and evaluate information and data from multiple perspectives and from multiple print and non-print sources, both primary and secondary.
- demonstrate ability to use Geographic Information Systems (GIS).
- analyze the influences of technology in the social studies.
- demonstrate the ability to create a multimedia presentation.
- use technology to create graphic representation of data.

- compose and edit original text (word processing).
- understand how to use technology for such civic activities as campaigning and lobbying.

Instructional Examples

Simulation software can be used for problem-solving, analyzing issues and decision making. Software exists that allows students to take the role of foreign policy advisors who must solve a fictional policy issue. They can "ask" experts about the issues, consult with the President of the United States and formulate decisions based on these consultations. Students must justify their conclusions in writing, which will increase their ability to write to persuade an audience.

Students learn about the rights and responsibilities of American citizenship by accessing the Maryland General Assembly Site. They can see what bills are on the docket and find the e-mail addresses of the legislators in their area. They can have class debates and write letters to the legislators about what they think should be done. This activity could count as part of the community service credit that students must earn to graduate.
http://mlis.state.md.us/

Educators attending the Maryland Technology Academy (MTA) as Fellows design activities that integrate technology into their curriculum. In one seventh grade activity synthesized information from primary source documents found via the Internet from museums and the National Archives and illustrated a Turning Point in History. The topics range from The Voyage of the Mayflower to the invention of the microchip. Students analyze both primary and secondary source. Students then present their video and computer documentaries, display boards, research papers, and dramatic presentations to judges from the community. To view this and additional MTA activities visit:
http://www.mdtechacademy.org

Students can take on the role of planners for a town or city. They can access data from the Census Bureau (http://www.census.gov/) such as population statistics by state and county and make predictions about where growth is occurring. Then they can then make an informed decision on how resources should be allocated.

Physical Education

Physical education is an applied science that requires students to use the processes and principles of science to conduct an ongoing experiment in which they are the subject. Technology devices such as heart rate monitors, body composition machines, blood pressure monitors, and spirometers which interface with computers provide objective biofeedback which allows students to evaluate the effects of physical activity on their own bodies. Computerized exercise equipment allows students to control the variables of time, distance and intensity to determine the effectiveness of their activity programs.

Camcorders combined with appropriate software allow students to apply biomechanical principles to their own movement in analyzing and improving physical skills. Technology allows teachers to vary instruction to meet the different skill and fitness levels of students.

A computer with Internet access serves as a daily station in the gymnasium to allow students to:

- obtain and evaluate current physical activity, scientific and consumer information.
- utilize software to determine energy needs and design personal fitness plans.
- download personal biofeedback and biomechanical information into electronic portfolios.
- record, evaluate, monitor and plan improvements in personal goals, personal program plans and data displays of personal progress.
- use biofeedback data to analyze the effects of a variety of physical activities and exercise plans on the systems of the body.
- apply the principles of exercise physiology to the development and continual revision of a personal fitness plan.
- use biomechanical and motor learning principles to analyze and refine personal performance of motor patterns and skills.
- interpret personal biofeedback and biomechanical data and use this information to solve problems and design activity programs to achieve personal goals.
- understand the concepts of aerobic and anaerobic activity.
- obtain, analyze and evaluate physical information, products and services.
- use technology to control the intensity and duration of physical activity to design tests to evaluate their current physiological status and progress.
- describe ways in which technology and medical advances can influence personal health.
- maintain an electronic journal/portfolio of motor learning progress, interpersonal and interpersonal responses to physical activity and physiological changes resulting from physical activity.
- determine the caloric expenditure of various physical activity plans.
- use biofeedback data to critically evaluate motor/fitness status and progress.

Instructional Examples

Students obtain up to date and historical information via the Internet, television, and print media to study, follow, and research the various Winter Olympic events. The students can virtually follow the athlete through their training program as they learn about the exercise physiology and exercise programs. The students then share with the class what they learned about the sport they are following and how it evolved at those particular Olympic games.

Using a digital cameras or video cameras, students take still pictures of class activities to study body mechanics and the basic rules of sports, games, and activities. These images

are imported into a computer, analyzed for correct mechanics, and used to create an informational digital movie on their individual activity. Students can then use information to understand and support their individual fitness program.

Health Education

Health literacy is the capacity to obtain, interpret and understand health information and services and the capacity to use that information in health-enhancing ways. A health-educated person is a critical thinker and problem solver, a self-directed learner and an effective communicator. Computers with Internet access should be incorporated into all health education lessons to provide students with access to current and ever-changing medical information and to allow students to ask specific questions of medical experts and utilize relevant software to analyze and evaluate personal health behaviors.

Students are continually asked to set personal goals and apply decision-making processes to real-life situations. Word processing programs, database and publishing programs allow students to maintain electronic journals, monitor progress toward personal goals, convey health information to others and gather and interpret health behavior data. Camcorders provide self analysis and immediate feedback opportunities as students practice life skills such as communications, refusal skills, decision making and conflict resolution.

As part of the Maryland Learning Outcomes for Health Education the student will:

- demonstrate the ability to evaluate resources from home, school and community and technological sources that provide valid information concerning health issues, services and careers.
- evaluate the validity of health information.
- demonstrate the ability to access school and community health services for self and others.
- evaluate the impact of technology, research and medical advances on personal, family and community health.
- evaluate the effectiveness of communication methods for expressing accurate health information.
- demonstrate the ability to analyze and adapt health messages and communication techniques to the characteristics of a particular audience.

Instructional Examples

Students study their favorite menu items from a fast food restaurant on the Internet to obtain the fat grams and calories and compare this to their daily-recommended allowance. They subtract their fast food calories and fat grams from the recommended calories and fat grams to find out how many calories and fat grams they have left to eat after eating just ONE fast food meal.
Fast Food Quest: http://www.cyberdiet.com/ffg/index.html

This site provide the number of calories and fat grams for each food item from the various fast food restaurants.
Nutrition Profile: http://www.cyberdiet.com/profile/profile.html
Students enter their basic body information including weight, height, and age to receive their daily-recommended number of calories and fat grams.

Students working in small groups use the Internet to research communicable or non-communicable diseases. The students can locate historical information, current patterns, and future predictions for each disease. For example the students would use the following website to gather information:
Center for Disease Control and Prevention:
http://www.cdc.gov/

The media influences people's opinions and how society views some drugs. The students learn about media literacy, research a particular drug, and the influence the media has on public opinion. The students examine their findings as a critical thinker and consumer of information. The student's share their information with the class about a particular drug, and include a movie or play a song that involves that drug.

Library Media

School library media programs are recognized as integral to student achievement because they provide all students and staff members with equal and timely access to ideas and information. Through an integrated instructional program, school library media specialists ensure that their students are effective users of ideas and information. The library media specialist also provides guidance to teachers in the application of technology and in the implementation of information literacy skills, using state and national standards as a basis. The national standards published jointly by The American Association of School Librarians and the Association for Educational Communications and Technology, *Information Power, Building Partnerships for Learning* and *Information Literacy Standards for Student Learning*, are nationally recognized as an excellent foundation for student learning in all curricular areas. Through the Maryland Information Literacy Standards, the library media program helps students to make real-world connections in the application of information technologies to become information-literate, independent learners and socially responsible citizens.

With the Information Literacy Standards, students will demonstrate the ability to:

- locate and use information resources, equipment, and other technologies.
- review, evaluate and select materials for an identified information need.
- learn and apply reading, research and critical thinking skills to organize information.
- comprehend content in various types of media.
- retrieve and manage information.

- demonstrate an appreciation for all types of literature and other creative expressions as sources of information and recreation.
- create materials in various formats.
- apply ethical behavior to the use of information.

Instructional Examples

The study of Maryland is conducted in all fourth grade Social Studies classes throughout the state. The purpose of this unit is to introduce students to the state in which they live and to provide them with an understanding of Maryland yesterday and today. One of the objectives is for students to be able to identify the regions of Maryland and their vast economic and geographic characteristics. To further their understanding, students will work with the library media specialist in conducting research (using print, non-print, on-line resources and a word processing program) to create a travel brochure persuading visitors to visit the unique regions of Maryland.

All students will demonstrate the ability to locate and use information resources, equipment, and other technologies, e.g. SAILOR, the Internet, and on-line information databases, by using the on-line public access catalog (electronic card catalog) to locate resources needed for a class assignment. After locating these resources, the student will then review and evaluate them to determine if they are the best resource to use for the assignment.

Students learn the stock market by participating in a nationwide stock market game. They realize in order to participate, they have to have knowledge of the "ends and outs" of the market. This includes the change in value and keeping track of the its increases as well as decreases. They decide in order to be successful at this game, they will first have to research the company they plan to purchase stock from, and then to read stock reports on a daily basis. After completing this research, they will track their findings in a spreadsheet program.

A 9th grade health class is researching the various diseases that have plagued the world. In conducting their research, they learn that print resources and the Internet are not "created equal." Information contained in books and on the Internet must be evaluated for its accuracy and authenticity by checking the credentials of the authors and their sources of information.

In completing an assignment about immigration, third students research information about the countries of their ancestors. They find information in a variety of resources, e.g. books, on-line and/or CD-ROM encyclopedias, and the Internet, and struggle to put the information in their own words. They have learned, however, that copying word for word from a source or printing it out to submit as their own work is wrong.

Fine Arts

Each of the fine arts disciplines (dance, music, theater and visual arts) is fundamental to human existence and pervades all aspects of life. The Essential Learner Outcomes for the Fine Arts, approved by the State Board of Education in October 1997, encompass several theoretical stances that contribute to the learner's understanding of arts content, processes and skills. The outcomes include a wealth of possibilities for making connections among the disciplines and the development of fine arts skills, creativity and aesthetic judgment within disciplines. These areas of focus are addressed within the context of a rich historical and cultural heritage. The outcomes encourage the exploration of contemporary technologies that significantly affect how the arts and humanities are produced and received and how they influence teaching, learning, perception and communication processes.

Fine arts classrooms should have sufficient technologies available for students and teachers to use them routinely for the following learning and assessment activities related to the Essential Learner Outcomes for the Fine Arts:

- gaining access to computer catalogs to find plays and other dramatic texts.
- using the Internet to study current reviews of artistic performances, playwrights, composers and artists.
- studying the images, artifacts and sounds included in major collections of world art.
- creating works of art.
- establishing process portfolios.
- documenting personal creative efforts over time.

Technologically-rich fine arts education environments enable instructors to make frequent use of the Internet and other current technologies. They provide exciting laboratory experiences for students, enabling them to:

- create, edit and preserve original works of art.
- experience world collections of artistic images, sounds and texts.
- explore an enormous range of career opportunities made possible through enlightened encounters that include creating, performing and responding to the arts.

Instructional Examples

In the arts, students use technology tools to compose and arrange music. Students working individually or as a group identify and experiment with non-traditional sources of musical sound utilizing sound generating and sequencing software.

Students studying theatre use technology to create visual images, design scenery, control lighting in theatrical productions, and design dance sequences. Students also use the Internet to explore styles of architecture from various periods and cultures and compare those styles to theatrical stage design, script writing style, and acting methods of past

eras. The students then compare contemporary dramatic literature and performance styles with new theatre facilities.

In art class students visit a museum on the Internet for a virtual tour of the exhibits. Students have access to museums around the world to view single artists or groups of artwork selected to express a theme. Students then determine and discuss the criteria used in selecting and arranging the exhibition.

Early Learning

Every pre-kindergarten to third-grade student has daily access in classroom and lab settings to state-of-the-art technology, including software, hardware, multimedia and communication tools. Young learners will be able to use technology to develop necessary social, cognitive and physical skills and construct meaning through the exploration and application of a variety of interactive materials. Through telecommunications, including e-mail and Internet, student learning extends to the world beyond the classroom. Young learners begin to make decisions about the quality and appropriateness of information provided through technology and how it may be used. The technology addresses multiple learning styles, accommodations and adaptations, and it supports a variety of learning strategies such as cooperative learning and student-directed learning.

Students will demonstrate abilities:

- in the basic operation and concepts for effectively using technology.
- to use technology tools such as word processing, database, spreadsheet, content-specific software, telecommunications and multimedia.
- to search for information and communicate long-distance.
- to read, write, edit text, solve math problems, apply scientific methods, learn about their environment and other cultures, and pursue the fine arts.
- to obtain and use information from a variety of teacher-guided and rapidly changing sources (e.g., e-mail, website).
- to work cooperatively with peers when using technology.
- to take care of technology and use it in a responsible way.

Instructional Examples

In an elementary classroom a teacher demonstrates and models a group writing activity using a computer and a projection device. Then working individually or in a shared writing experience young learners write about an assigned topic. They compose at the keyboard for easy revision and editing as they work. Graphics and digital images are easily incorporated into the writing piece for support. Students use the text to speech feature in word processing programs to hear what they have written. Peer editing further enhances the students writing skills in a cooperative learning environment.

An early childhood literacy project uses technology to increase reading and writing achievement. The writing process is introduced as early as kindergarten and students can use word processors to draft stories and reports. The use of "Key-Pals," pen pals who communicate via computer, is an essential part of the writing process. Students communicate with peers in another school, sharing and editing writing. The project involves teachers, library media specialists, reading specialists, and instructional assistants in the development, planning and delivery of technology supported reading and writing. Their web site provides valuable resources for the primary teacher.
http://www.mcps.k12.md.us/curriculum/littlekids/

Career and Technology Education

Career and technology education (CTE) prepares students for further education, careers and lifelong learning through academic instruction, career development, technical skills development and work-based learning. Career and technology education instructional programs incorporate different forms of technology currently utilized in business and industry to ensure that students understand and evaluate the uses of current technologies for a variety of purposes and situations. These skills are designed to add value to the students overall education program.

The student will:

- identify and use resources and strategies for keeping abreast of advances in technologies.
- identify and describe current technologies used to meet a variety of needs, including obtaining and managing information, communicating, performing work and solving problems in a variety of situations.
- evaluate the uses of current technologies in specific situations.
- identify needs not being met by current technologies and emerging technological solutions that may meet those needs.
- use technologies safely, effectively, legally and ethically.
- use appropriate technologies to obtain, store, manage analyze and convey information.
- use appropriate technologies for research, creatively and problem solving.
- monitor, evaluate and plan to improve personal uses of technologies.
- analyze and evaluate the effects of technologies on individuals, society and the environment.

Technology Education

Technology education is an integrated, experienced-based instructional program designed for citizens who are knowledgeable about technology—its evolution systems, techniques, uses and social and cultural significance. It allows the application of mathematics and

science concepts in technology systems. Students discover, create, and solve problems by using a variety of tools, machines, materials, processes and computer systems. The Maryland curricular framework for technology education identifies the technology-based outcomes for students enrolled in technology education to ensure that students will:

- demonstrate knowledge and skills regarding diverse technology systems, including their functioning and applications.
- demonstrate knowledge of the nature of technology, and the relationships and impacts among technological achievement, the environment, the advancement of science, the individual, and society. The contexts for this knowledge shall be historical, current and futuristic.
- demonstrate the ability to solve problems with technology using a systems approach, higher-order thinking skills, individual and collaborative ingenuity, and a variety of resources including information, tools and materials
- make ethical decisions about technological issues, including the development and use of technology and technology resources.
- demonstrate in an experiential setting the safe, effective and creative use of technology resources – including tools, machines and materials – in carrying out technological processes.
- apply science and mathematics, language arts, social studies and technological concepts to solve practical problems and extend human capabilities.
- apply knowledge of – and perform tasks representative of – technology-based careers, including engineers, technologists, technicians and craftspersons.
- recognize the multicultural and gender diversity included in past, present and future uses of technology.

The National Standards for Technological Literacy outline what students should know and be able to do in order to achieve a high level of technological literacy. The Maryland learner outcomes for technology education align to the following National Standards:

- develop an understanding of the nature of technology including the characteristics and scope, core concepts and relationships and connections between technology and other fields.
- develop an understanding of technology and society including the effects of technology on the environment, the role of society in the development of technology and the influence of technology on history.
- develop an understanding of design including engineering design and the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
- develop abilities for technological world including applying the design process, using and maintaining technological products and systems, and assess the impact of products and systems.

Instructional Example

In Technology Education classrooms students often apply math and science concept to solve practical problems. Students in middle school investigate the practical uses of domed structures in today's society. From studying Euler's law, students will investigate the structural properties of various polyhedrons, build models of polyhedrons and build a model of a geodesic dome based on an icosahedron.