K-12 Technology

Instructional Commentary
Technology Foundations

The Ohio technology standards provide a basic understanding of technology including how to use technology tools to enhance teaching and learning, acquire and communicate information, solve problems and design solutions.

The Secretary's Commission on Achieving Necessary Skills (SCANS) was one of the first governmental entities to identify reasons why the study of technology in K-12 schools is important. The SCANS committee was charged with determining the skills that young people need in order to succeed in the world of work. They found that "high performance workplaces require competent workers who have the ability to manage resources, work amicably and productively with others, acquire and use information, master complex systems and work with a variety of technologies" (SCANS 1991).

Learning basic technology competencies is important for all students—those who directly enter the workforce and those who pursue higher education. "Accountants and engineers manage resources, information, systems, and technologies—both require competence in these areas even though balancing a set of books has little to do with building a bridge" (SCANS 1991). The application of technology may differ by profession or field of study, but foundation level knowledge, skills and abilities form the basis for success.

The U.S. Department of Education has produced two national education technology plans. A third plan is being developed and is expected to be published during the 2004-2005 school year. The first plan, *Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge* (1996), reinforced competencies expressed by the SCANS committee.

"Technology increases students' learning opportunities, motivation, and achievement; it helps students to acquire skills that are rapidly becoming essential in the workplace; and it breaks the barriers of time and place, enabling students in any community, no matter how remote or impoverished, to have access to high-quality instruction" (U.S. DOE 1996). The plan also identified technological literacy as the "new basic" or the "Fourth R" along with reading, writing and arithmetic.
Goals of the first national education technology plan specified that:

- All teachers in the nation will have the training and support they need to help students learn to use computers and the information superhighway;
- All teachers and students will have modern, multimedia computers in their classrooms;
- Every classroom will be connected to the information superhighway;
- Effective software and online learning resources will be an integral part of every school's curriculum.

The second national education technology plan, *e-Learning: Putting a World-Class Education at the Fingertips of All Children (2000)*, stated that "a meaningful unified approach to providing students with the skills they will need for their futures must be more than a checklist of isolated technology skills, such as knowing the parts of a computer, writing drafts and final products with a word processor, or searching for information using a CD-ROM database" (U.S. DOE 2000). The second technology plan identified five new goals:

- Goal 1: All students and teachers will have access to information technology in their classrooms, schools, communities and homes;
- Goal 2: All teachers will use technology effectively to help students achieve high academic standards;
- Goal 3: All students will have technology and information literacy skills;
- Goal 4: Research and evaluation will improve the next generation of technology applications for teaching and learning;
- Goal 5: Digital content and networked applications will transform teaching and learning;

The second technology plan defined the purpose of achieving technology and information literacy on both an individual and societal level:

- Individual level- technology and information literacy skills will help consumers better assess products and make more intelligent buying decisions;
- Societal level- technology and information literacy skills will help citizens make better decisions through heightened understanding of the scientific and technological foundations of many public policy issues facing the nation and the world.
No Child Left Behind (NCLB) charges the Secretary of Education with developing the nation’s third National Education Technology Plan. The plan will establish a national strategy supporting the effective use of technology to improve student academic achievement and to prepare students for the 21st century. The U.S. Department of Education, Office of Education Technology has established a Web site (www.nationaledtechplan.org) “to help facilitate the development of the new technology plan” (U.S. DOE 2003).

The U.S. Department of Education views technology as having the capability to be a “transforming” tool, enabling organizations and individuals to gain significant advantages in work and life. Increased access to technology alone will not fundamentally transform education. It will take a willingness to explore the changes that must occur around technology to create the environments that best support its use. The U.S. DOE Technology Office is taking feedback via its Web site (www.nationaledtechplan.org) from interested parties regarding needs or concerns that should be addressed in the new national technology plan (U.S. DOE 2003).

The State Education Technology Directors Association (SETDA) has identified strategies for implementing NCLB and assessing technology competence that may be found in the SETDA National Leadership Institute Toolkit: States Helping States Implement No Child Left Behind (SETDA, December 2002).

The toolkit states that the, “long-term goal of technology literacy is for students to use the tools of their society with skill; in an ethical, accurate, and insightful manner to meet the demands of the 21st Century workplace” (SETDA, December 2002).

**National Organizations**

Standards from four national organizations, the International Society for Technology in Education (ISTE), the Association for Educational Communications and Technology (AECT), the American Association of School Librarians (AASL), and the International Technology Education Association (ITEA) informed the development of Ohio’s technology standards.

ISTE states, “Our educational system must produce technology capable kids” (ISTE 2003). ISTE has developed a comprehensive set of national education technology standards referred to as NETS. The NETS project first established the National Education Technology Standards (NETS) for Students as a framework to provide educators with information about new learning environments where students could use technology to enhance their learning. The standards and performance indicators identify technology skills and conceptual knowledge which students should acquire and apply to curricular areas (ISTE 2003).
Effective educational technology use can enable all students to become:

- Capable information technology users;
- Information-seekers, analyzers, and evaluators;
- Problem solvers and decision makers;
- Creative and effective users of productivity tools;
- Communicators, collaborators, publishers, and producers;
- Informed, responsible, and contributing citizens.

(ISTE 2000)

ISTE next created the National Education Technology Standards (NETS) for Teachers (cnets.iste.org/teachers) which describe the abilities that teachers need to create learning environments for students to become technology-capable. NETS for Teachers was followed by the National Education Technology Standards (NETS) for Administrators (cnets.iste.org/administrators), the goal of which was to identify abilities that administrators should have to be leaders in a technology-rich environment.

The American Association of School Librarians (AASL) and Association for Educational Communications and Technology (AECT) collaborated to create Information Power: Building Partnerships for Learning which includes the National Information Literacy Standards for Student Learning. (AASL/AECT 1998).

"The information explosion has provided countless opportunities for students and has dramatically altered the knowledge and abilities they will need to live productively in the twenty-first century. Students must become skillful consumers and producers of information in a range of sources and formats to thrive personally and economically in the communication age."

(AASL/AECT 1998, p. 2)

The International Technology Education Association (ITEA) is a professional association for technology education teachers who teach a curriculum called "technology education," which focuses on problem-based authentic learning utilizing mathematics, science and technology principles (ITEA 2003).
Technological studies involve:

- Designing, developing, and utilizing technological systems;
- Open-ended, problem-based design activities;
- Cognitive, manipulative, and effective learning strategies;
- Applying technological knowledge and processes to real world experiences using up-to-date resources;
- Working individually as well as in a team to solve problems.

ITEA worked in partnership with the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA) to develop the Technology for All Americans Project. Technology for All Americans: A Rationale and Structure for the Study of Technology (ITEA 1996), addresses issues such as: "What does every student need to know and be able to do with technology? How should the articulated program in technology from Grades K-12 be organized? Is there a structure for teaching technology that can withstand the accelerating changes in our technological environment?" (ITEA 2003).

ITEA next published Standards for Technological Literacy: Content for the Study of Technology (STL), which identifies content that will help students become technologically literate. The content includes knowledge, abilities, and the capacity to apply both knowledge and abilities to the real world (ITEA 2000). This was followed by Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards (ITEA 2003).

Resources:


Making Technology Connections Across Standards and Disciplines

"Growing up is about learning. The Net Generation are beginning to process information and learn differently than the boomers... The destination is different and so is the route the kids must take"  
Don Tapscot, *Growing Up Digital*

The technology academic content standards can be interwoven into each curricular discipline. The purpose of integrating technology is to help students make realistic connections between what they learn in each content area and the real world.

"Curriculum integration with the use of technology involves the infusion of technology as a tool to enhance learning in a content area or multidisciplinary setting. The technology enables students to learn in ways not previously possible"  
(ISTE 2000).

Although the technology standards are printed in a linear fashion, they should be taught in an integrated style. Multiple standards, benchmarks and indicators may be addressed in one lesson or unit. The knowledge, skills and abilities featured within the individual technology standards are interconnected across all of the technology standards. These concepts may be integrated into other subject areas or taught in partnership with teachers of other academic content areas. Technology lends itself to curriculum integration, team teaching and multidisciplinary instruction such as MST—mathematics, science and technology.

Student experiences designed to focus on these relationships will help build interconnected knowledge. An interdisciplinary curriculum cuts across subject-matter lines to focus on comprehensive world issues that bring together the various segments of the curriculum into meaningful association. This provides coherence and allows student experiences to add up to more than just a miscellaneous collection of topics or activities  
(American Association of Advancement of Science 1993).

There is a body of research related to how children learn that supports an interdisciplinary curriculum. "The brain may resist learning

"By building on the best of current practice, standards aim to take us beyond the constraints of present structures of schooling toward a shared vision of excellence"  
National Research Council, p. 10.
A C A D E M I C C O N T E N T S T A N D A R D S

fragmented facts that are presented in isolation. Learning is believed to occur faster and more thoroughly when it is presented in meaningful contexts, with an experiential component. Put to use in the classroom, the brain research points toward interdisciplinary learning, thematic teaching, experiential education, and teaching that is responsive to student learning styles" (Lake, p. 6).

Understanding the Technology Standards

The technology standards address three intersecting literacy areas: computer and multimedia literacy, information literacy and technological literacy, which may be taught simultaneously with other academic content areas. The technology standards are meant to be used in concert with each other.

Standards (1) Nature of Technology and (2) Technology and Society Interaction are overarching; they are important to each literacy area. Standards (3) Technology for Productivity Applications and (4) Technology and Communication Applications serve as the basis for Computer and Multimedia Literacy.

Standard (5) Technology and Information Literacy serves as the basis for Information Literacy.

Standards (6) Design and (7) Designed World serve as the basis for Technological Literacy.

Computer and Multimedia Literacy includes the ability to appropriately use hardware, software applications, multimedia tools, and other electronic technology. It harnesses the use of educational technology tools for productivity, communication, research and problem-solving.

Information Literacy is the acquisition, interpretation, and dissemination of information. Information literacy focuses on effective methods for locating, evaluating, using, and generating information. Technology-based information literacy skills encompass the utilization of the Internet and other electronic information resources for research and knowledge building.

Technological Literacy addresses the abilities needed to participate in a technological world. It is the intersection of mathematics, science, and technology. It specifies unique knowledge, devices, and capabilities used to solve problems. It identifies career connections between technology and the world of work. Technological literacy includes technology education and pre-engineering concepts.
Cross-Curricular Connections

The first standard, the *Nature of Technology*, helps students understand the core concepts of technology. It addresses the natural and human-made world. There are direct interconnections to Ohio's science academic content standards, particularly the *Physical Sciences* standard and the *Science and Technology* standard.

The second technology standard, *Technology and Society Interaction*, assists students with becoming responsible and ethical users of technology. It defines how technology has impacted society and how societies wants and needs impact technological innovation. Implicit connections occur in Ohio's social studies academic content standards in the *Citizenship Rights and Responsibilities* standard. Connections also exist within Ohio's foreign language academic content standards, in the *Communities* standard.

Skills identified within the third technology standard, *Technology for Productivity Applications*, are fundamental technology skills that can be applied to every content area. Benchmarks and indicators within this standard address the "how to" and focus on use of technology tools, selection of the correct tool for the need, and application of technical "know how" to whatever subject area or topic being studied at the time.

The goals of the fourth technology standard, *Technology and Communication Applications*, are to prepare students to communicate, publish and present the ideas, information and opinions learned in their curricular studies. Electronic communication and distance-learning mechanisms are covered in this standard.
The fifth technology standard, *Technology and Information Literacy*, should be integrated into every content area. This standard identifies strategies for conducting research in a technological environment. Effective Internet search strategies and Web site evaluation skills addressed in this standard are transferable to every content area.

The sixth technology standard, *Design Standard*, focuses on the attributes of design and features concepts of engineered design. Students learn about important inventions and technological innovations from a design standpoint. Then, they design solutions and construct devices used to solve technical problems. The importance of evaluating designs for quality is reinforced. This standard has several connections to mathematics and science. In order to design accurate solutions, students must apply concepts learned in the mathematics standards *Measurement, Geometry and Spatial Sense, Patterns, Functions and Algebra, and Data Analysis and Probability*. Many connections also exist within the science standard *Science and Technology*.

Much technological activity is oriented toward designing and creating new products, technological systems and environments. The technological design process involves the application of knowledge to new situations or goals, resulting in the development of new knowledge.

ITEA 1996, p. 18
The processes are those actions that people undertake to create, invent, design, transform, produce, control, maintain and use products or systems. The processes include the human activities of designing and developing technological systems; determining and controlling the behavior of technological systems; utilizing technological systems; and assessing the impacts and consequences of technology.

ITEA 1996, p. 16

Technology standard seven, the *Designed World*, addresses real-world applications and supports career connections. Students explore the seven technological systems: medical, agricultural and biotechnologies, energy and power, information and communication, transportation, manufacturing and construction technologies. They learn how each system works, how the system contributes to society, what types of changes have taken place over time in the system and basic skills that support career paths within the various systems.

General Technology Systems Model

Resources:


Making Real-World Technology Connections

As Ohio's technology academic content standards publication goes to press, staff of the NASA Mars Exploration Rover Mission are directing the robotic testing, analysis, and communications devices on Rover Spirit and the Rover Opportunity as they operate on the surface of the red planet and transmit data and graphic images back to Earth.

The women and men who designed, engineered and built the orbiting craft, descent parachute, inflated-cushion landing sphere, landing craft platform and Rover vehicle that needed robotic sample testing and analysis equipment, communications devices, and related systems and software programs represent technical skills and abilities of the highest order. While all students and citizens may not be required to perform at this level of competence, everyone on Earth is engaged in applications of technology during daily routines and workplace tasks, as well as making decisions about technology-linked developments in their local communities and across the nation. A strength of Ohio’s technology academic content standards is in making those real-world connections for students.
It is important to make such connections across all levels of the curriculum. For example, an examination of the Ohio standards connection to professional level technology program criterion, the Accreditation Board for Engineering and Technology, ABET Engineering and Technology Standards reveals many of the key points that Ohio students are expected to know and be able to do in their study of technology. The ABET standards require that engineering programs must demonstrate that their graduates have:

- An ability to apply knowledge of mathematics, science, and engineering;
- An ability to design and conduct experiments, as well as analyze and interpret data;
- An ability to design a system, component, or process to meet desired needs;
- An ability to function on multi-disciplinary teams;
- An ability to identify, formulate, and solve engineering problems;
- An understanding of professional and ethical responsibility;
- An ability to communicate effectively;
- The broad education necessary to understand the impact of engineering solutions in a global and societal context;
- A recognition of the need for, and an ability to engage in, life-long learning;
- A knowledge of contemporary issues;
- An ability to use techniques, skills, and modern engineering tools necessary for engineering practice.

(ABET 2003).

In order for all students to become technologically literate, they must, through practice, be able to acquire, interpret and disseminate information using computer and multimedia technologies and other means; understand and use physical technologies, such as production techniques and the ability to transport people and goods using appropriate energy and power systems; and be aware of the effects of bio-technologies particularly those related to agriculture, medical technology, regulation and safety and waste management on all aspects of their lives.

Appropriate technology matches realistic uses of technology with practical problems. For example, a wind turbine and solar photovoltaic panel being used in a hilly Southeastern Ohio pasture to power the electric

As technology products and processes become more complex, it is important to have specially designed environments and personal protection for the technicians.

The long-term goal of education is not only to help children develop personal integrity and fulfillment but also to enable them to think, reason and make decisions necessary to participate fully as citizens of a democracy.

~John Dewey, Democracy and Education
pump for keeping a cattle watering trough full, results in better care of the animals, saves the farmer time and labor costs, and has the added benefit of keeping the cattle out of a nearby stream, which also solves a problem of stream bank erosion and impaired water quality.

Throughout Ohio's technology academic content standards is a concern for identifying benchmarks and grade-level indicators that will provide authentic learning experiences for students. Making real-world connections is the particular goal of Standard 7, Designed World. This standard provides students an understanding of their role in the designed world including its processes, products, standards, services, history, future, impact, issues and career connections. Some of the themes students engage in are understanding technological systems, technical careers, safety, technical communication, engineering practice, system management, use and maintenance of technological systems, technology assessment, emerging technology and design application.

In order for students to become effective users of technology, they must make connections between fields of technology and their curricular studies. These connections encompass computer literacy, information literacy and technological literacy skills. The study of technology allows students to become technologically literate through understanding the nature of technology, practice of appropriate social and ethical behavior related to technology; the effective use of computer and multimedia resources; capability in designing and producing technological products and systems, ability to use technology for research, information acquisition, communication, and to facilitate cognitive skills.

Technology knowledge, ways of thinking and acting and technical capabilities are important tools in preparing students in a global economy for high-skill, high-knowledge jobs in research, information management, engineering, computer programming, quality control, supervision and fabrication and maintenance (National Academy of Engineering 2002). In implementing these standards, it will be important to have supporting authentic, problem-based, creative instructional strategies and performance-based assessments. The real-world emphasis of Ohio's technology academic content standards will create links between each learner's needs, his or her interests and strengths; and between the classroom, technology laboratory and the world of work and community life.
Resources:


Program Planning

Ohio’s technology academic content standards provide clear expectations for all students. They form the foundation for what every student should know and be able to do in technology programs throughout the state. While local programs and curriculum may build beyond those expectations, the benchmarks and grade-level indicators provide clarity for instruction. Identified content and skills should be the focus of teaching and learning at each grade band and level. To effectively implement a standards-based technology program, teachers and curriculum leaders must determine how instructional programs can be organized, implemented and maintained in Ohio’s classrooms, schools and districts.

All technology academic content standards should be part of the district’s technology program. A fully-articulated program of technology studies should include each of the three literacy areas addressed in Ohio’s technology academic content standards—computer and multimedia literacy, information literacy and technological literacy. Teachers and curriculum leaders will find that not all content in the standards is new and that sections of their current lessons, projects and units fulfill the expectations of the standards.

Program planning and implementation is a shared responsibility. Teachers, department chairs, technology coordinators, library media specialists, administrators, curriculum leaders, school boards, parents and community members play important roles in making decisions about local technology programs. Knowledge of standards, best practices and sound research should be incorporated into the conversations that go into developing a coherent technology program in which all components—curriculum, instruction and assessment—fit together well.

A fully-articulated technology program will increase the opportunity for students to learn. The technology program may follow the path of other academic disciplines in that elementary school foundation-level technology skills and abilities support the grade-level appropriate curriculum of the academic content area. Then, as students progress through the grade levels from elementary school to middle and high school, their technology expertise is accelerated at the same time as the level of difficulty of academic content increases.

Basic or introductory technology concepts are addressed by benchmarks and indicators in the K-2, 3-5 and 6-8 grade-bands of Ohio’s technology academic standards. Concepts may be integrated into discipline-specific
Educators involved with the delivery of technology curriculum may include: computer literacy teachers, technology education teachers, library media specialists, computer science teachers, technology integration specialists and classroom teachers.

"New technologies offer teachers additional resources to use as they plan to meet a range of levels, learning styles, and the individual needs of students. Computers and other technologies do not replace other tools or activities, but add to the teacher's complement of tools."

Van Scoter and Boss, 2002.

Studies or delivered in a team-teaching environment where the technology teacher and/or library media specialist collaborate with the classroom teacher. This kind of integrated learning makes technology usage purposeful because students learn skills that are directly connected to their studies.

Technology Education courses taught by technology education teachers, marshal concepts from technology, mathematics and science and provide students with the ability to use technology to solve problems. Design solutions may be taught in a team environment, as well. School districts may offer advanced courses in technology education (e.g., Design Technology, International Baccalaureate Program course) and computer science as students progress through the K-12 technology program.

School districts should review the following items as they begin to revise existing technology programs: Ohio's K-12 technology academic content standards, district or building Continuous Improvement Plan (CIP), district-wide technology program of studies (Curriculum Outline), technology courses of study, the district technology plan, No Child Left Behind requirements and other pertinent district needs or goals. Districts should remember that as technology goals are revised, professional development needs may change, thus requiring professional development plans to be revised simultaneously.

**No Child Left Behind (NCLB)**

No Child Left Behind, Title II, Part D, Subparts 1 and 2, identifies goals that determine how education can be enhanced through technology. These goals address how technology can work well in schools. The primary goal of NCLB is to improve student academic achievement through the use of technology in elementary and secondary schools. Secondary goals include assisting students in becoming technology-literate by the end of the eighth grade and ensuring that all teachers are able to integrate technology into the curriculum in order to improve student achievement (No Child Left Behind: Desktop Reference, U.S. DOE, 85-87).

As school districts begin to comply with the eighth-grade technology literacy component of NCLB, they may need to reorganize course offerings so that foundation-level technology courses and skills are provided before the end of the eighth grade.
Early Childhood Technology Experiences

Several strategies for using technology to enrich the educational experiences of early childhood students have been identified by the National Association for the Education of Young Children. These suggestions may assist teachers in providing an atmosphere where technology is routinely integrated:

- Include technology use in day-to-day classroom activities;
- Use technology to extend activities and expand experiences;
- Place computers inside classrooms, not separately in labs;
- Select software that builds upon topics in the curriculum;
- Use technology to connect cross-curricular subject-matter.

(NAEYC 1998).

In addition to computers and discovery-oriented software, the use of cameras, voice and video recorders, talking books, tools for building and creating things, and other educational technologies may help expand children’s social, emotional, language and motor development. Opportunities to use technology as a catalyst to interact with classmates, teachers and learning objects may increase a child’s ability to understand and construct knowledge (Van Scoter 2001).

The use of computers and technology tools with preschoolers, kindergarteners and primary-grade students should be based on developmental appropriateness. Generally, computer use by children under the age of three is not recommended (Hohmann 1998). The American Academy of Pediatrics recommends that television viewing and video and computer-game playing time be limited to one to two hours per day for very young children (AAP 2000).

Assistive Technology

Assistive technology devices and services enable students with disabilities to achieve higher expectations, participate in less restrictive environments and gain independence. Assistive technology devices and services are tools that support the student’s ability to perform educational tasks more effectively and with more efficiency.

"With appropriately selected and used devices and services, students with disabilities can access the same educational opportunities and meet the same academic standards as their classmates" (NASBE and U.S. DOE 1999).

The Individuals with Disabilities Education Act (IDEA) amendments of 1997 require that the need for assistive technology be considered for
Assistive technology is "any item, piece of equipment or product system, whether acquired commercially or off the shelf, modified or customized, that is used to increase, maintain, or improve functional capabilities of a child with a disability."

IDEA - P.L. 105-17, Part A - General Provisions, Section 602, Definitions.

Section 508(a)(2)(A) of the Workforce Investment Act of 1998 includes the Rehabilitation Act Amendments that require the federal government’s Architectural and Transportation Barriers Compliance Board to publish standards establishing a definition of electronic and information technology and the technical and functional performance criteria necessary for accessibility of such technology.

DisabilityInfo.gov is a comprehensive online Web site designed to provide people with disabilities the information they need. The site provides access to disability-related information and programs made available by the government on numerous subjects, including civil rights, education, employment, housing, health, income support, technology, transportation and community life. (disabilityinfo.gov)

Accessible Technology

Technology is accessible when it is easily used by people with disabilities and is designed to be available to anyone, no matter what assistive technology he/she might use or how he/she accesses the information (SREB, 2003). The Southern Regional Education Board (SREB) published a brochure Accessible Information Technology Resources: A Quick Reference Guide for Educators that identifies several organizations, agencies and Web links that provide information on assistive and accessible technologies.

The World Wide Web Consortium (W3C) through its Web Accessibility Initiative (WAI) is developing technologies, guidelines and tools in order to "bring the Web to its full potential" (World Wide Web Consortium 2003). In addition to the tools that support accessible Web design used by designers of Web content, educators and other Web consumers can use tools to evaluate Web accessibility. Web site validators allow Web users to verify accessibility or inaccessibility of Web sites. Bobby™ (www.cast.org/bobby) a common Web validation tool may be used to test a Web site’s accessibility compliance with the World Wide Web Consortium accessibility guidelines and the 508 guidelines (Lazzaro).
Resources:


Planning for Instruction

The Committee on Education and Human Resources (CEHR) of the Federal Coordinating Council on Science, Engineering, and Technology (FCCSET) stated:

"Citizens of the future must be equipped to make informed decisions in this age of rapidly developing knowledge, changing technology, sophisticated information, and communication systems. Accordingly, America's performance in science, mathematics, engineering and technology must be second to none in the classroom and the workplace."

(FCCSET, CEHR 1993).

Ohio's technology academic content standards were developed to ensure that all students would become technologically literate citizens to meet the needs of the future. It is through the understanding and effective use of technology that students will be better equipped for everyday life and the workplace.

Ohio's academic content standards provide the foundation for planning integrated instruction and assessment in the classroom. Although the benchmarks and indicators are presented as separate statements of knowledge, the intent is to promote integrated instruction. The indicators suggest specific content for lessons that will integrate content and concepts across the standards and disciplines to build mastery towards the benchmarks. This integration is a vital component of standards-based education.

Standards-based education is a process for planning, delivering, monitoring and improving academic programs in which clearly defined academic content standards provide the basis for content in instruction and assessment. In standards-based education, the standards help ensure that students learn what is important, rather than allowing textbooks to dictate classroom practice. Student learning is the focus of standards-based education. Standards-based education aims for a rigorous and in-depth student understanding that goes beyond traditional textbook-based or lesson-based instruction.

Although standards define individual skills, standards-based education does not promote a skill-by-skill methodology. Multiple standards can and should be integrated in instructional activities. From the benchmarks, you must identify and document the enduring concepts or "big ideas" that students should learn so they will ultimately understand
the standards and benchmarks in technology. "The term enduring concept refers to the big ideas, the important understandings, that we want students to 'get inside of' and retain after they’ve forgotten many of the details (Wiggins and McTighe, p. 10)."

In a standards-based classroom, teachers start with the state standards as the basis for classroom instructional planning, rather than starting with a textbook or other classroom materials. Teachers select a unit of instruction that meets the standards, benchmarks and indicators and use the standards to determine how the unit shall be designed, assessed, delivered and evaluated. The graphic in Figure One shows how standards form the basis for all planning, instruction and assessment. Note how the arrows extend from the academic content standards. Also note that resources, which may have previously been the basis for instructional planning, are selected only after decisions have been made about content, assessment and instruction; note that the arrows in the graphic lead to resources—no decisions are driven by resources.

Figure One

"Start with the end (the goals or standards) then consider the evidences of learning (assessments) before planning the teaching and learning experiences."

Wiggins and McTighe, 1998
The standards define the outcomes, or expectations, of what students need to know and be able to do. These outcomes include big ideas that students will acquire by the end of the unit and more discrete ideas that might be developed at the lesson or activity level within the unit.

These defined outcomes serve as the basis for assessment planning within instruction. The outcomes can help teachers plan a pre-assessment that can be administered and used to determine the starting points and focus for instruction. A summative or final assessment should be planned to address both big and discrete ideas, thus assessing student performance and the success of instruction, and identifying any needed re-teaching. In addition, the outcomes help focus ongoing instructional assessment throughout the unit with teachers monitoring students’ progress. At times, students may also use self-assessment strategies to monitor their own progress. These assessments provide teachers with the information that they need to plan and deliver focused, effective instruction for each student in their classrooms.

Resources:


Vignettes

Vignette 1: Cast Your Vote

The following vignette includes concepts from social studies, English, mathematics and technology.

The social studies class is learning about presidential elections. They are studying campaigns, voting and elections. This particular unit requires students to:

1. Determine which candidate they support;
2. Write an informative paper about the candidate;
3. Deliver a persuasive speech about the candidate;
4. Vote in a mock election;
5. Analyze vote results.

Before the students can determine which candidate they support, they must find information about all of the candidates. Students begin by identifying what they need to learn about a candidate that will help them decide whether they support the candidate or not. They determine their need to know the candidate's party affiliation, experience and stance on issues.

Students start their research by visiting the library and looking for books, magazines and newspaper articles about the candidates. They use the Internet and electronic resources. They quickly discover that there are a variety of Web pages about each candidate, so they need to evaluate the Web sites. They determine the authority of the Web site. They want to find out who the author or owner of the site is. They want to determine if the candidate sponsors a Web site to provide information to the public. Then they identify the bias of the Web site. If the site is sponsored by a supporter of the candidate, it may overplay the contributions of the candidate. If the site is sponsored by an opponent of the candidate, it may intentionally misrepresent the candidate. The students want to base their candidate selection on accurate information.

Next, the students organize their information by using concept maps or graphic organizers. This helps them to categorize their research on each candidate based on the questions that they wanted to answer (candidate's party affiliation, experience and stance on issues).

Students review their research and watch campaign commercials. They analyze each campaign commercial and try to identify the main message in the commercial. They begin by determining whether it is a positive or negative ad. They try to determine who sponsored the ad. They check
whether there are any references to news articles or a candidate's voting record. If so, they review the references to see if they support the message in the ad or not. They also assess the ad to determine if the production techniques influence the message. They ask themselves if the same speech were delivered in a different setting, would the meaning change? Was the setting or backdrop manipulated through technology to produce a different effect on the viewer?

After carefully analyzing all of their research, students select a candidate to support. The students are now ready to begin writing their (2. informative papers) about the candidate that they selected. They use desktop publishing software to create papers that include photos, tables and bibliographic citations.

Next, the students are ready to develop their (3. persuasive speeches). They think about the purpose of their speech first. The goal is to use their research to write a speech that will persuade their classmates to vote for the candidate that they selected. The students use presentation software to add impact to their speeches. They include photos, video, sound charts and other technical effects that may enhance their speeches.

The students decide to take a "straw poll" vote before they present their persuasive speeches. They create a bar graph of the results, comparing the straw poll results that took place before the persuasive speeches to the final vote results. This enables them to see if any of the speeches effectively persuaded votes to change.

The students deliver the (3. persuasive speeches) supplemented by electronic presentation materials. They ask each other questions and debate issues. Then they participate in the (4. mock election). They record, chart and tally the votes.

The concluding activity is to (5. analyze the vote results). The students create spreadsheets, bar graphs and pie charts of the results of both the straw poll and the final election. They determine the percentage of total votes that were changed after the straw poll. They calculate the percentage of votes gained and lost by each candidate between the straw poll and the final vote.

Real-World Connection

Technology was integrated throughout this vignette. The student learned about campaigns and elections, writing and speaking, data analysis and technology skills.

Even if the student does not follow a career path involving politics or technology, the student has developed technology knowledge, skills and abilities which will help him/her be an informed consumer of civic information.
Vignette 2: Curriculum Integration Opportunities in a Technology Systems Experience

Students are engaged in a Construction Systems course that provides them with a working understanding of the key elements used in the planning, designing and constructing of an on-site structure. It is recognized that the construction industry is a major industry in contemporary society and has a dramatic influence on the environment in which people live. In our technological society, it is necessary for all people to obtain a fundamental understanding of construction practices, including the procedures for servicing and maintaining structures. Overall, the Construction Systems course experience enables students to:

- Relate construction technology to the broader context of industry and technology;
- Appreciate, understand, and perform selected production and servicing practices;
- Appreciate and have an understanding about construction technology tools and materials;
- Perform selected management practices in planning, directing and controlling;
- Describe the interrelationships within and among construction, the environment, individuals, and society;
- Develop an awareness of careers in construction technology and related fields;
- Develop an awareness of the significance of construction technology in the past, present and future;
- Develop responsible and safe work attitudes and the ability to function as a member of a group;
- Develop consumer and citizenship skills regarding the design and maintenance of buildings; and knowledge of development issues.

The goal is to have students learn these concepts through hands-on activities, using contemporary construction tools, management techniques and materials. Student experiences are designed to include exposure to various types of structures, including residential, commercial and industrial buildings, bridges and public utilities. The emphasis is on student understanding of all the concepts associated with each of the major content elements, as well as the interrelationships of management and production functions in the construction technology system. In order for students to be successful, and also to get the most
out of the experience, coordination with other subject teachers will provide opportunities for the application of academic content to the solution of construction-related problems. The availability of school space and resources might limit the size and complexity of student projects and activities. Construction-related assignments may include development of models, materials testing on component parts, building wall section modules, or construction a full-size or scale building. One unique opportunity available in many communities might be working as a partner with a local Habitat for Humanity project team. Working in the community on a real project with the project's homeowner/family should have added benefits in fostering a greater sense of responsibility and attention to detail in their work.

Student research, explorations and activities will cover the life cycle of a structure. Major topics include the research and development process, preparing the site, building the structure, enclosing the structure, installing utility systems, finishing the structure, servicing structure systems and salvaging constructed projects.

Career education links include identifying and adopting the roles representing the construction trades and engineering/technical professionals, and related legal, planning and technical sales fields in class projects. Opportunities to talk with persons working in the construction technology systems area, and participating in experiences to test-drive their interests in technical fields and related professional level careers would be beneficial to student learning.

Academic content links include English language arts applications supporting student research, written communications, technical communication and the design and presentation of reports. Social studies engages students in issues of procedures and reasons for zoning, building codes, construction safety regulations, construction site environmental protection concerns, and issues of community and economic sustainability.

Mathematics provides a background for understanding concepts used in the surveying of a building site, building foundation layout, computing strength of structural components and computing structure surface areas for determining quantities of various building materials required. The concepts include:

- Understanding the specifications of building systems such as computing airflow volumes needed in determining appropriate heating, ventilation and air conditioning system equipment selection;

- Developing the ability to figure and project the costs of alternative building designs and energy efficiency materials and practices.
Science applications will focus on understanding the physics of structural design and the functioning of electrical and mechanical systems such as:

- Determining the performance qualities and effectiveness of heat and sound insulating materials;
- Understanding the environmental issues and environmental health science concerning indoor air quality;
- Recognizing the basics in the chemistry of paints, adhesives, plastics and building finishing materials;
- Being able to make sound judgments regarding alternative fuels and energy efficiency practices.

Several students in the class are also participating in a weekend design workshop series for high school students sponsored by the regional chapter of the American Institutes of Architects. These students are invited to share with the class what they have learned about design, site planning, model building, concept presentations, and featured architectural projects in the area.

Vignette 3: Window into a Middle School Technology Program

The middle school technological studies program began with the teacher meeting with a class of students. They were analyzing a recent project: mass-production of a toy. Students had researched, designed, manufactured and distributed the item to their customers. Discussions later centered on an upcoming technology festival exhibit and an assignment requiring a written report on technology systems careers. In the course of the project, the students entered the technology laboratory area, which is designed for multiple activities. Students worked at different stations, studying how a computer can simulate manufacturing processes, how a video camera is used to produce the school's morning announcements and how hydroponics is used to raise food. One group arranged posters on the wall to create a time line illustrating inventions and the history of technology. Another team of students used a computer's desktop program to prepare a research report on the impact of technology. In another corner students recorded results as their balsa wood model bridges were tested with heavy weights.

Later, the teacher explained that the class included students with a full range of abilities. All benefited from the study of technology. The teacher explained that the technology course included opportunities for practical application of mathematics, science, social studies and English.
It was noted that all students would need to understand technology, which includes developing knowledge, ways of thinking and acting, and capabilities. The teacher expressed the belief that theory and practice must be blended to provide an opportunity for students to learn by doing.

A key component of this vignette, which is necessary for all rich technology programs, is integration. The integration of technology into all content areas enhances learning and supports effective instruction. As teachers develop their lessons they should also take into consideration the following points:

1. **Engage students in active instead of passive learning.**

   For education to be of value, learning must be retained. Research has shown that learners will not retain things that they mimic, nor can they use things memorized to help them understand something new.

2. **Focus on how different learners progress in their understanding of ideas.**

   Understanding the progression of how learners develop ideas to increasing levels of sophistication should be part of the teacher’s professional knowledge. For example, differences in learning styles are more readily visible at the computer, where children have the freedom to follow diverse paths towards a goal (Wright 1994). Also, gender differences emerge when children engage in programming. In one study, a post-test-only assessment seemed to indicate that boys performed better. However, assessment of the children’s interactions revealed that the boys took greater risks and thereby reached the goal. In comparison, girls were more keen on accuracy; they meticulously planned and reflected on every step (Yelland 1994).

3. **Provide structured review and reinforcement to maintain a high level of retention.**

   Constant reinforcement of ideas and concepts can help to ensure long-term learning of skills, processes and strategies. In addition, the integration of content previously learned and the provision of contexts for learning can ensure that students have a scheme for new learning.

Lessons that include performance-based tasks or projects allow for a greater opportunity to evaluate student understanding. Formative or regular ongoing assessments are used to gather information to improve teaching and learning. Summative assessments allow for evaluation of what students know and are able to do at the completion of their tasks or projects.
The following vignette shows the value of a performance-based project.

**Vignette 4: Developing an Electrical System Model** This semester, students in Mr. T's Tech Prep automotive class have been studying the electrical system of the automobile. He has been able to describe and explain to his class the various components of the system in such a manner that all students passed their written test in which they were to describe the purpose of each component of the system. Phase Two of the unit required students to design and create a model of the electrical system of an automobile.

On the first day of Phase Two, students were divided into four teams of four. Mr. T began this portion of the unit with a discussion of what his expectations were for the project. He listed for his students on a slide-show the expectations for the project:

1. Design and create a model of the electrical system of the front end of an automobile;
2. The design must include the following components: headlights, turn signals, emergency lights, a horn and a power source. Students could add additional components for extra credit;
3. Research new and upcoming technology geared towards the electrical systems of automobiles;
4. Present their project (design process, completed design and research findings) to a committee of local community automotive experts. Each team would be expected to answer any questions asked of them by the committee.

After explaining his expectations for the students, Mr. T and the teams spent the remainder of their lab time discussing and creating the criteria or rubric that would be used by the committee of automotive experts to evaluate each project.

Day Two began with a pre-assessment. The students would need to correctly design electrical circuits to be able to connect all their components without burning them up. This would require an understanding of Ohm's Law (Voltage = Current X Resistance, $V = IR$) and an understanding of how to work with two types of electrical circuits, series and parallel. As a pre-assessment, Mr. T gave a quiz that required the use of Ohm's Law. After grading the quizzes, Mr. T found that some students did not understand how parallel circuits worked, and so a review lesson was needed.
Students were divided into groups. Each group included a student that led the group in reviewing how parallel circuits worked. The students used materials provided by Mr. T. As the students reviewed the concepts, Mr. T walked around the room observing and providing tips when necessary. Upon completion of the review, Mr. T felt satisfied that all his students understood the content, so the students were allowed to begin their designs.

As a way to monitor their work, students were required to create a spreadsheet listing all the components they were going to use and the tolerances connected to each component. Also on this spreadsheet, teams were expected to display all calculations needed for their design. Upon completion, the teams began to create their "electrical systems.” Teams were given a week for the designing, creating and testing of their projects. Throughout the process, Mr. T took on the role of an advisor to the teams. He did not directly provide answers to their questions, but provided guidance so that team members were able to determine their own answers.

After a week, Mr. T evaluated the progress of each team and found that the teams were ready to proceed to the next phase of their projects. Each team was split into two sub-teams. Two students worked on the slide show presentation that would explain their design process and design, and the remaining two students researched new and upcoming technology in the field of automotives.

The researchers of each team were required to prepare a one-page report of their findings. Students were permitted to search on the Internet for information but were required to use two technical magazines from a library for their research. As a former professional from the field of automotives, Mr. T understood the value of teamwork and the importance of communication within a team. Therefore, as part of the project, team members were required to present their project to a committee of experts.

Mr. T also required that the two sub-teams of each team switch roles when they were to present their project. For example, on Team A, Lisha and Dominic were responsible to create the slide show showing their design process and design while Brandon and Jamir were responsible for the research. Therefore, when Team A presented, Lisha and Dominic talked about the research, and Brandon and Jamir presented the slide show. The students did not prefer switching roles to present but were able to learn more as a result.

After several days of sharing their work and practicing speeches, the teams presented to the committee of automotive experts. The students were nervous as they shared their projects but felt it was a valuable lesson. Having to share their experiences and answer questions permitted the team members to see how much they had each learned.

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**Standard 5 Technology and Information Literacy**

**Grade 11**

**Benchmark D**

Evaluate choices of electronic resources and determine their strengths and limitations.

**Indicator 1**

Modify a search through the use of different key words and other techniques specific to an electronic resource.

**Indicator 3**

Differentiate coverage of electronic resources to select information need.
Meeting automotive experts from their community provided another benefit—connections to possible future employers.

Mr. T's unit incorporated standards, benchmarks and indicators in a way that addressed various learning styles. The strong connections made to specific indicators and benchmarks helped move his students to mastery. By involving the local community in the work, he opened important lines of communications with major stakeholders.

Teachers and curriculum leaders must consider how each lesson fits into the progression of the year. They must look at the skills being developed and how each lesson influences what can be explored in the future. Additionally, they must plan and develop assessments that provide valuable information about student understandings and drive lesson design. These components of standards-based education will provide Ohio teachers with a clear instructional plan to help all students meet the demands of the 21st century.

**Vignette 5: A Student's Perspective**

During my sophomore year of high school, I signed up for the course, Introduction to Technology. I didn't know much about computers and technology, nor did I know what the class was about. We started off with the basics. We studied programs that we were going to be using throughout the year, and so it didn't matter how much computer experience I had in the past. Everyone started off at the same level. Throughout first semester, we went over how to draw 3D views, designing on the computer, and occupations that deal with technology, but our midterm project became one of the most interesting assignments I have ever been given. My peers and I were asked to design and build a toy. Our requirement was to include three mechanisms within the toy and write a report. We studied mechanisms and how they were used in our everyday lives. I worked a few months on this project, and at the end of the first semester, I realized I did not know how precise a mechanism had to be in order to function.

During the second semester we learned how to make 3D drawings on the computer, studied the importance of parts and simple objects, like a paper plane, and our final project was to create a robotic arm and create a Web site with our report. I was to use hydraulics or pneumatics to have the arm pick up and carry an Easter egg filled with clay. It was extremely challenging, but then I figured out different techniques to get the arm to work.

Since then, I became intrigued on how things worked or how things moved. When I see a machine, a toy or anything that moves without human hands, instead of just watching the object, I study it and try to
figure out what makes it perform. I went from not knowing anything about the technology world, to being fascinated by the fact it was all around me. The class changed the way I think and how I look at technology.

Female Student, Dublin Scioto High School

Resources:


The Role of Assessment

A strong, effective, aligned educational system has three parts. Standards; curriculum and instruction; and assessment aligned with the standards; combined to create an integrated system.

Ohio has adopted clear and rigorous academic content standards for its students. Educators and members of the public need to know if students meet these standards. Assessment is a means of collecting evidence about what students know and are able to do. The process of assessment provides students with opportunities to demonstrate their understandings related to content standards. A comprehensive and thoughtful assessment system also provides educators with needed information for improving instructional planning and decision-making.

Ohio's comprehensive assessment system includes several types of assessment:

- Classroom assessments;
- Diagnostic assessments;
- Achievement tests;
- National and international assessments.

Each type of assessment provides invaluable information to Ohio's educators, parents, students and communities. While each approach to assessment supports the others, each also serves its own unique purpose.
# Ohio's Comprehensive Assessment System

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<th>Assessment Types</th>
<th>Basis for Content</th>
<th>Purpose</th>
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| Classroom Assessments      | Local Courses of Study and Standards | • Measure process as well as product of student understanding and knowledge.  
                             |                                    | • Inform teachers and students about progress.                              |
|                            |                                    | • Provide information for instructional planning.                        |
| Diagnostic Assessments     | Ohio’s Academic Content Standards  | • Monitor student progress.                                              |
|                            |                                    | • Make instructional decisions (e.g., intervention, enrichment).           |
|                            |                                    | • Provide information to students, parents and teachers.                  |
| Achievement Tests          | Ohio’s Academic Content Standards  | • Measure student achievement.                                            |
|                            |                                    | • Demonstrate evidence of continuous improvement at the state and local level. |
|                            |                                    | • Provide data for Ohio’s accountability system.                          |
| National and International Assessments | National and International Standards | • Compare Ohio achievement against that of other states and nations. |
Classroom Assessment

In the classroom, effective educators use various forms of assessments to plan and provide effective, targeted instruction in the academic content standards and to help students identify their areas of strength and weakness. As educators develop their classroom assessments, they should realize that the role of assessment in the integrated technology classroom should include three main areas:

1. Assessment of programs;
2. Assessment of the use of technology;
3. Assessment of student achievement.

(National Research Council 2001).

Assessment of programs

Technology in the classroom should be a seamless component of the curriculum. Whether technology is the focus (in a technology course whose focus is technology education) or technology that is to be integrated into another content with the intent to enhance the opportunity to meet teaching and learning goals, educators must assess their purpose for the technology. This requires educators to evaluate their programs to ensure objectives are well planned and aligned to the academic content standards.

Assessment of the use of technology

The appropriate use of technology in a classroom allows students the opportunity to demonstrate what they know and are able to do. Assessing how students use technology to demonstrate their understanding of the technology is beneficial to both students and educators. The effective use of technology by students can be evaluated by using authentic or alternative assessments such as a performance-based assessment. Performance-based assessments (e.g., problem-based learning, design problems, design teams) involve requiring students to perform a task and observing and rating the process against set criteria.

This criterion is often developed within a rubric. The intent of the rubric should be to detect strengths and weaknesses and identify areas of needed improvement. Students help develop the rubric which can be used at any time during the activity. It can be used by students as a self-assessment as they work on the activity and/or as a final assessment of their work. Their involvement with the rubric clarifies and enhances the learning process because students understand the expectations of the activity or task.

"It is essential that a technology plan identifies and implements quantifiable assessments, so that the plan results can be measured and activities can be adjusted in accordance with those results."

A Proven Method of Assessing Technology Integration For Teachers and Students, p. 7

"If students are to participate effectively in the [assessment] process, they need to be clear about the target and the criteria for good work, to assess their own efforts in light of the criteria, and to share responsibility in taking action in light of the feedback."

National Research Council, p. 9
There are basically two different types of rubric formats. One is a holistic rubric that describes the qualities of performance for each performance level (for example, each score point from 1 to 5). Another is an analytic rubric that assigns scores to different components of a task. Regardless of the type of rubric an educator develops, there are a number of steps that should be followed during development:

1. Use the academic content standards to ensure that the assessment is aligned with the standards. Determine the essential learning objectives that need to be measured by the rubric;

2. Describe what evidence students will need to produce to show that they have mastered the learning objectives described in the rubric;

3. Make sure that the learning objectives and performance expectations are clearly communicated for students on the assessment task;

4. Determine the number of levels in the rubric appropriate to the task or activity. In some cases, a three-point rubric may be sufficient. A four-point rubric is more effective at forcing distinctions between responses;

5. Describe the performance expected at each score point in each characteristic;

6. Score some student responses with the rubric to ensure that it is fair, easy to use and effective at making the appropriate distinctions between levels of performance. Revise as needed;

7. Explain to students how they will be scored on the task. (Share rubric content and process with students before activity begins);

8. Compare student work against the rubric.

**Assessment of student achievement**

The assessment of student achievement often occurs concurrently while assessing the use of technology. The question that often arises is, "Does the use of technology increase student achievement?" Research studies have shown that it is difficult to identify a direct correlation between the use of technology in the classroom and student achievement. However, the studies do indicate that students in technology-rich environments showed increased achievement in preschool through higher education for both regular and special needs children.  

(Schacter 1999)

Therefore, in designing lessons, educators must evaluate the intent or purpose for the assessment in their lessons. Does the assessment measure what it was designed to measure? Does it measure student
understanding? Are students given the opportunity to show what they know and are able to do? Grant Wiggins (1998) notes that educators should, "Use simulations or real applications that require students to use knowledge with an overarching purpose, audience, and setting (context) in mind." The goal is to provide authentic assignments that require students to apply the skills that they have mastered. These authentic assignments will create within the classroom opportunities to better measure student understanding.

When assessing individual achievement of students, the use of both formative and summative assessments is encouraged. Formative assessments (i.e., assessments given during the activity to monitor student progress) permit educators to determine areas that need strengthened in their students so that the teacher can revise instruction to meet the needs of students. Summative assessments, which occur at the completion of an assignment, allow students to demonstrate what they have learned and to determine if learning objectives have been met. Both types of assessments together give a clearer picture of what students know and are able to do in meeting the academic content standards.

**Diagnostic Assessments**

Ohio's assessment system enhances the work teachers do in classrooms by providing for annually administered diagnostic assessments. These assessments are drawn from the expectations found in Ohio's academic content standards grade-level indicators.

Depending on the content area involved, diagnostic assessments are administered at various grade levels from kindergarten through eighth grade. They are designed to provide common instruments that districts may use to obtain a second perspective on the strengths and weaknesses of individual students. They provide teachers with important information for instructional planning. These assessments also identify students who need additional help meeting the content standards and preparing for the achievement tests.

**Achievement Tests**

Achievement tests, including the Ohio Graduation Tests, are a third component of Ohio's comprehensive assessment system. They provide periodic checkpoints of student progress in meeting the benchmarks established by the state's content standards.

The results obtained from the achievement tests provide a broad measure of student achievement. The results provide guidance for districts in making program decisions. They may be used to make decisions related to the allocation of resources at the state and local levels.
National and International Assessments

Ohio's assessment system is complemented through the state's participation in national and international assessment processes, such as the National Assessment of Educational Progress (NAEP) and the Third International Mathematics and Science Study (TIMSS). Participation in these assessments enables Ohio to compare the achievement of its students with that of students in other states and nations. In this way, Ohio ensures that its standards are sufficiently rigorous and world class.

Ohio has taken great strides to ensure alignment with the Elementary and Secondary Education Act (ESEA), known as No Child Left Behind (NCLB). NCLB requires that all students become technology literate by the end of the eighth grade. This means that basic or introductory technology concepts should be achieved before the end of eighth grade. Educators that align their curriculum to the technology academic content standards will meet this mandate.

The Best Preparation for All Types of Assessment

In Ohio's aligned educational system, educators collaborate to design, refine and enact instructional plans and classroom assessment strategies based upon the benchmarks and grade-level indicators that are contained as part of the academic content standards. These educators know:

- That they will not have to set aside good classroom instruction to prepare students for assessment experiences;
- That they are evaluating students against common reference points shared by all Ohio educators;
- That they are preparing students for the statewide diagnostic and achievement tests.

In this way Ohio's aligned system helps ensure that all students are prepared to meet the rigorous demands of the new century.
Resources


North Central Regional Educational Laboratory. *Critical Issue: Using Technology to Improve Student Achievement.* 1999, p. 4.


