Planning Learning:

Developing Technology Curricula

Addenda Series to—*Standards for Technological Literacy: Content for the Study of Technology* and *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards*

ITEA International Technology Education Association

ITEA Technology for All Americans Project (TfAAP)

ITEA Center to Advance the Teaching of Technology and Science (CATTS)

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No pessimist ever discovered the secret of the stars or sailed an uncharted land, or opened a new doorway for the human spirit.

– Helen Keller
(1880-1968, Citation Unknown)

Preface

With increased support for educational standards, teachers need resources to help them engage in standards-based reform. The International Technology Education Association (ITEA) is publishing a series of addenda for this purpose. *Planning Learning: Developing Technology Curricula* offers teachers and other curriculum developers suggestions and tools for planning, developing, and evaluating standards-based technology curricula.

ITEA originally developed *A Guide to Develop Standards-Based Curriculum for K–12 Technology Education* in 1999 under the leadership of Dr. Brigitte Valesey. It was field tested in ITEA's Center to Advance the Teaching of Technology and Science (CATTS)[1] Consortium states around the country. In March 2000, ITEA's Technology for All Americans Project (TfAAP) released *Standards for Technological Literacy: Content for the Study of Technology* (*STL*). Three years later, in March 2003, ITEA-TfAAP released *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* (*AETL*). In the spring of 2003, ITEA made the decision to have the TfAAP staff write a new curriculum document that would be based on the content standards in *STL* and the companion standards in *AETL*. Thus *Planning Learning: Developing Technology Curricula* was written. Several individuals helped make this document possible, and acknowledgements are provided in Appendix A.

Planning Learning is a resource for developing standards-based technology curricula. Section 1 provides defining characteristics of quality curricula and discusses the relationship of curricula to technology programs. The importance of a planned curriculum is also emphasized. Section 2 explains the differences between standards-based and standards-reflected practices and presents five fundamental planning questions of standards-based curricula. Section 3 provides a multi-step process for developing and revising curricula. Section 4 provides a general overview of the curriculum evaluation process. Section 5 is a call to action that provides direction to teachers and other curriculum developers to gain support for technological literacy from others. There are also several resources in the appendices, including forms that can be photocopied for teachers and other curriculum developers to use as they work toward standards-based reform of technology curricula.

Planning Learning is most useful when users are already familiar with the technology content standards in *STL* and the companion standards for student assessment, professional development, and program enhancement in *AETL*. However, teachers and other curriculum developers may use *Planning Learning* as a bridge to understanding the vision of the standards as it pertains to curriculum development. ITEA has developed additional addenda that examine topics such as standards-based programs (*Realizing Excellence*), professional development (*Developing Professionals*), and student assessment (*Measuring Progress*). See pages iv–v for a listing of the ITEA Professional Series Publications. ITEA welcomes feedback on all of the guides in this addenda series as we work together to ensure technological literacy for all students.

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[1] CATTS is the professional development arm of ITEA. Visit www.iteawww.org for more information.

Advancing Technological Literacy: ITEA Professional Series

The Advancing Technological Literacy: ITEA Professional Series is a set of publications developed by the International Technology Education Association (ITEA) based on *Standards for Technological Literacy* (ITEA, 2000/2002) and *Advancing Excellence in Technological Literacy* (ITEA, 2003). The publications in this series are designed to assist educators in developing contemporary, standards-based K–12 technology education programs. This exclusive series features:

- Direct alignment with technological literacy standards, benchmarks, and guidelines.
- Connections with other school subjects.
- Contemporary methods and student activities.
- Guidance for developing exemplary programs that foster technological literacy.

Titles in the series include:

Technological Literacy Standards Series

- *Standards for Technological Literacy: Content for the Study of Technology*
- *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards*
- *Technology for All Americans: A Rationale and Structure for the Study of Technology*

Addenda to Technological Literacy Standards Series

- *Realizing Excellence: Structuring Technology Programs*
- *Developing Professionals: Preparing Technology Teachers*
- *Planning Learning: Developing Technology Curricula*
- *Measuring Progress: A Guide to Assessing Students for Technological Literacy*

Engineering By Design: Standards-Based Technological Program Series

Elementary School Resources

- *Technology Starters: A Standards-Based Guide*
- *Models for Introducing Technology: A Standards-Based Guide*

Middle School Resources

- *Teaching Technology: Middle School, Strategies for Standards-Based Instruction*
- *Exploring Technology: A Standards-Based Middle School Model Course Guide*
- *Invention and Innovation: A Standards-Based Middle School Model Course Guide*
- *Technological Systems: A Standards-Based Middle School Model Course Guide*

High School Resources

- *Teaching Technology: High School, Strategies for Standards-Based Instruction*
- *Foundations of Technology: A Standards-Based High School Model Course Guide*
- *Engineering Design: A Standards-Based High School Model Course Guide*
- *Impacts of Technology: A Standards-Based High School Model Course Guide*
- *Technological Issues: A Standards-Based High School Model Course Guide*

Engineering By Design: Standards-Based Technological Study Lessons

Elementary School Resources

- Kids Inventing Technology Series (KITS)

Elementary/Middle School Resources (Grades 5–6)

- Invention, Innovation, and Inquiry (I^3) Units
  - — *Invention: The Invention Crusade*
  - — *Innovation: Inches, Feet, and Hands*
  - — *Communication: Communicating School Spirit*
  - — *Manufacturing: The Fudgeville Crisis*
  - — *Transportation: Across the United States*
  - — *Construction: Beaming Support*
  - — *Power and Energy: The Whispers of Willing Wind*
  - — *Design: Toying with Technology*
  - — *Inquiry: The Ultimate School Bag*
  - — *Technological Systems: Creating Mechanical Toys*

Secondary School Resources

- Humans Innovating Technology Series (HITS)

Note: All of the publications in the ITEA Professional Series are available online at www.iteawww.org or by contacting:

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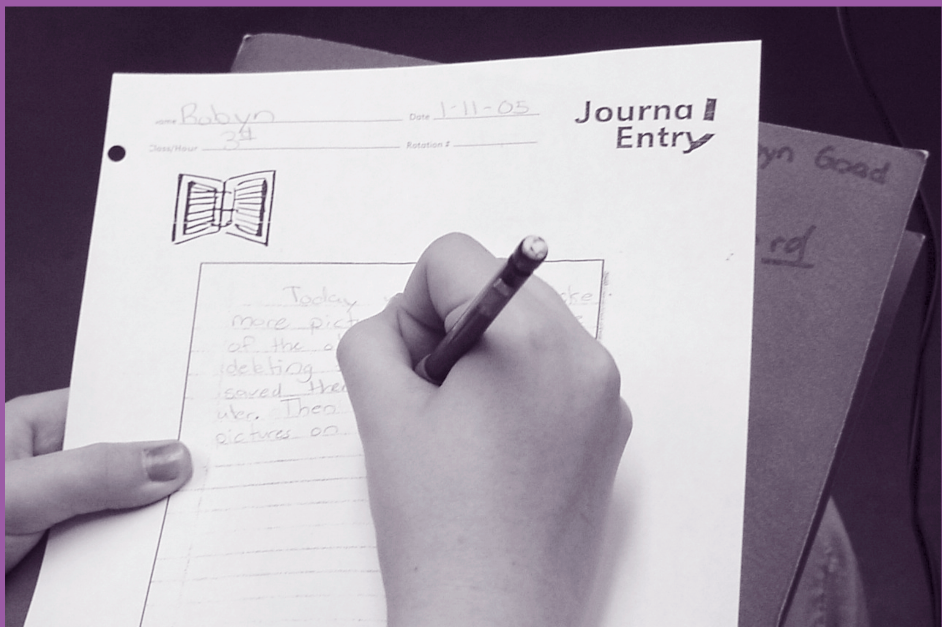
ITEA: Teaching Excellence in Technology, Innovation, Design, and Engineering (TIDE)

SECTION 1
Introduction to Curricula



This section provides defining characteristics of quality curricula and discusses the relationship of curricula to programs. The importance of curricula in the educational process is emphasized.

A curriculum provides a written plan that defines how content is arranged, ordered, and emphasized.

Curricula provide specifications of the way content is delivered, including the structure, organization, balance, and presentation of content in the laboratory-classroom.

Many educators view curricula as "glue" that bonds together the content (what is to be learned), instruction (what is to be taught), and student assessment (how well the content is being learned).

***Planning Learning* offers suggestions and tools to help teachers and other curriculum developers plan, develop, and evaluate standards-based technology curricula.**

The technology curriculum is a written plan that defines how content is arranged, ordered, and emphasized. It provides a means by which the teacher and students interact. A curriculum is the plan for the delivery of the content day-by-day in the laboratory-classroom, which engages students in learning. The curriculum allows for flexibility and freedom so that individual teachers can adapt it to student needs and ensures that the content is based on the appropriate standards.

Many educators view curricula as the "glue" that bonds together content (what is to be learned), instruction (how the content is taught), and student assessment (how well the content is being learned). In other words, the recipe for teaching includes content as the essential ingredients; instruction as the process of mixing and combining ingredients; and student assessment to allow for adjustments during the process or in preparation for the next "batch." The manner in which these three elements relate to each other is discussed in some detail in Section 3, which presents an approach for curriculum development or revision. *Planning Learning* offers suggestions and tools to help teachers and other curriculum developers plan, develop, and evaluate standards-based technology curricula.

Technological Literacy Standards

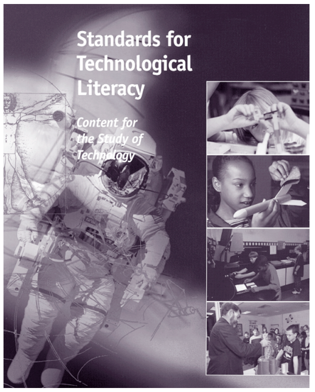
Nationally-developed educational standards set forth the content for most school subjects, including what every student should know and be able to do in order to be literate. In 2000, the International Technology Education Association (ITEA) released *Standards for Technological Literacy: Content for the Study of Technology* (*STL*). *STL* provides 20 standards (and numerous related benchmarks) to establish the content for the study of technology that leads to technological literacy.[2] Appendix B is a listing of the content standards in *STL*.

***Technology* is the innovation, change, or modification of the natural environment to satisfy perceived human needs and wants.**

***Technological literacy* is the ability to use, manage, evaluate, and understand technology.**

2 *STL* was created by ITEA's Technology for All Americans Project, with funding provided by the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA).

***Curricula* are the way the content is delivered each day in the laboratory-classroom. Curricula include the structure, organization, balance, and presentation of the content to the student and provide the plan followed by the teacher for instruction. *STL* is not a curriculum.**



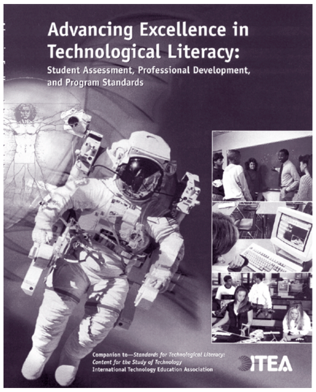
STL does not represent a curriculum. Rather, it provides the major concepts and ideas, connections to meaningful activities and experiences, and developmentally-appropriate knowledge and abilities for each learner. *STL* can be used as the major conceptual content organizer in a curriculum to reflect technology. The standards in *STL* are built around the following guiding principles:

- They offer a common set of expectations for student learning.
- They are developmentally appropriate for students.
- They provide a basis for developing meaningful, relevant, and articulated curricula at the local, state, regional, and provincial levels.
- They promote interdisciplinary content connections with other areas of study in Grades K–12.
- They encourage and promote active and experiential learning.

The curriculum is a crucial component in the teaching and learning process.

The curriculum is a crucial component in the teaching and learning process. Without a well-planned curriculum, the standards-based content would be presented without any coherence or organization. *STL* defines the technological content to be studied across Grades K–12.

Content for the study of technology is distinct and different from educational (instructional) technology. While educational/instructional technology teaches students to use information and communication technology tools, content for the study of technology includes the ability to use, manage, evaluate, and understand technology from a broad perspective.



Companion standards in *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* (*AETL*) (ITEA, 2003) direct educators as they structure and organize the content standards. In other words, *AETL* provides the means for using *STL* in the laboratory-classroom. Appendix C is a list of the student assessment standards in *AETL*; Appendix D is a list of the professional development standards in *AETL*; and Appendix E is a list of the program standards and guidelines in *AETL*.

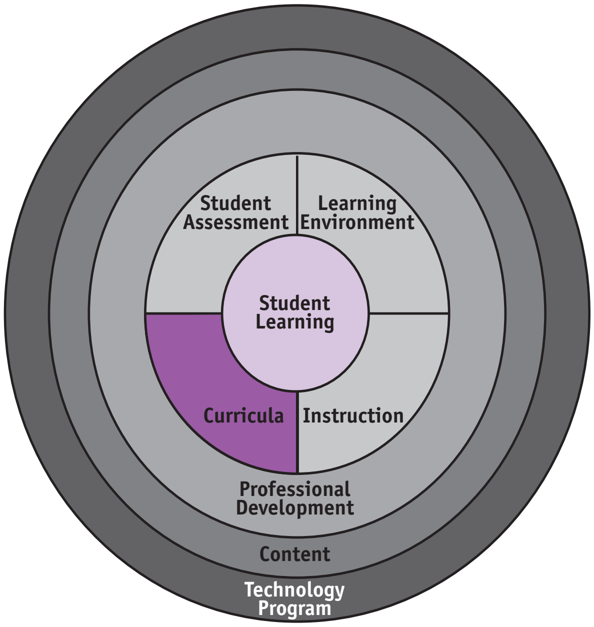
Within *Planning Learning* the term *content standards* refers to the standards in *STL*. *Technological literacy standards* refers to the standards in both *STL* and *AETL*.

Curriculum in the "Big Picture"

The technology curriculum is only one component that influences student learning. For student learning to be of the highest possible quality, educators must consider the entire program in which student learning is occurring. A program is **everything** that affects student learning, including content, professional development, curricula, instruction, student assessment, and the learning environment, implemented across grade levels (ITEA, 2003). Thus, program is a very large and all-encompassing term in education. At the technology program level, courses will be chosen that build upon students' knowledge as they progress from one grade to the next. As teachers and other curriculum developers design curricula, they must attend to the bigger picture and consider how the curriculum contributes to student learning. A graphic model of the components of an educational program is shown in Figure 1.

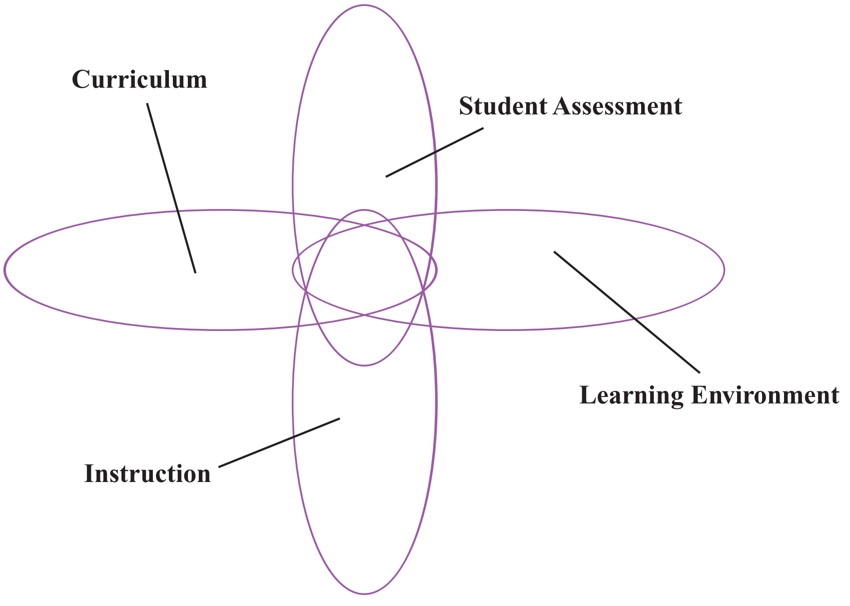
The *technology program* includes everything that affects student learning, including content, professional development, curricula, instruction, student assessment, and the learning environment, implemented across grade levels as a core subject of inherent value.

Figure 1. Selected Program Components



While Figure 1 serves as a visual for how program components surround student learning, it fails to illustrate the overlapping nature of curricula, student assessment, instruction, and the learning environment. Figure 2 provides an example of how these components interact.

Figure 2. How Components Interact in a Program



Student assessment both drives and supports the curriculum. A listing of the student assessment standards for technological literacy is provided in Appendix C. When a curriculum is developed, the instructional strategies and methods must be planned at the same time and coordinated with the learning environment. All four components must be integrated if maximum student learning is to take place.

Developing Effective Curricula

One approach to identifying a quality curriculum is to decide what it is *not*. A curriculum is simply not a collection of textbooks. It is not simply a collection of activities. Similarly, it is not simply a number of hands-on projects. These examples would not result in quality learning. A similar concern would apply to a teacher who rotates students through numerous modules without a broader plan that connects comprehensively to the technological literacy standards. These examples are not likely to result in technologically literate students, which should be the primary goal of technology curricula (AETL *Program Standard 2, Guideline C*). The process presented in *Planning Learning* includes activities, but activities alone do not constitute a curriculum.

Quality curricula are always well thought out and planned by the teacher or other curriculum developer(s). A curriculum is not simply a collection of textbooks, a collection of activities, or a number of hands-on projects.

The ultimate vision of a good curriculum is that every student can become technologically literate.

Quality curriculum results from thorough planning by teachers and other curriculum developers. Curriculum begins with standards as the basis for what is to be taught. Both formative and summative student assessment are integrated within the curriculum. Likewise, the strategies, techniques, and methods of instruction are planned as an integral part of the curriculum. After the program and course level of the curriculum is planned, units are synchronized into it. Units are made up of daily lesson plans. The learning environment is planned and organized to reflect the curriculum. Effective teachers continually assess and monitor student learning and overall progress toward the content standards of the course. Also, the curriculum is continually revised to remain current and to resonate with individual concerns and interests within the classroom, the school, and the community.

SECTION 2
Planning Curricula

This section explains the differences between standards-based and standards-reflected curricula and presents five fundamental questions for planning standards-based curricula.

There are a number of questions that can help educators plan a standards-based technology curriculum. The questions on pages 12–13 in this section are presented in the International Technology Education Association (ITEA) Addenda Series (see pp. iv–v) as fundamental questions of standards-based planning in general; however in *Planning Learning*, the questions focus on curricula development.

Curriculum Should be Standards-Based and Not Standards-Reflected

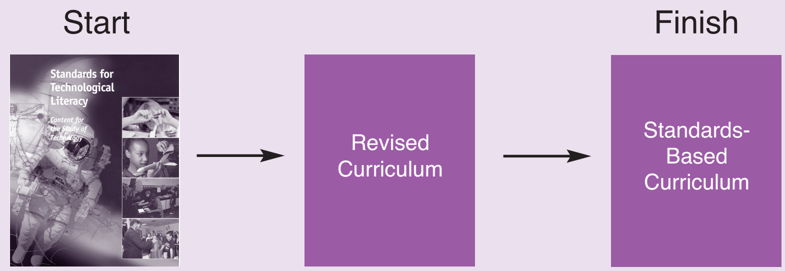
***Standards-based* technology curriculum starts with *STL* as the content base. Teachers and other curriculum developers begin by selecting the specific standards and benchmarks that should be covered in the curriculum.**

Standards-based technology curriculum starts with the standards in *Standards for Technological Literacy: Content for the Study of Technology* (ITEA, 2000/2002) as the content base. Teachers and other curriculum developers begin by selecting the specific standards and benchmarks that should be covered in the curriculum. If curricula are being developed for a specific course (several units, for example), then the developer should primarily select from the standards and benchmarks that have been identified as essential for that course. The student assessment and instruction likewise will be based on the three sets of companion standards and guidelines to *STL* in *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* (*AETL*) (ITEA, 2003). The ultimate goal is that what students know, are able to do, and ultimately understand is based on the technological literacy standards.

It is strongly recommended that curriculum for the study of technology <u>not</u> be **standards-reflected** (see Figure 3). Standards-reflected means that the teacher or other curriculum developer starts with existing curriculum material, course guides, textbooks, modules, and/or activities and then "checks-off" the *STL* standards and benchmarks. By using the standards-reflected approach, *STL* and other content area standards become an afterthought and are not the central basis for developing the curriculum. Standards-reflected curriculum is often based on what the teacher or the students like to do and not necessarily on what students need. Thus, standards-reflected curricula are often not standards-based but activity-based. Standards-reflected curriculum is misleading because it gives the impression that practices are standards-based when they are not.

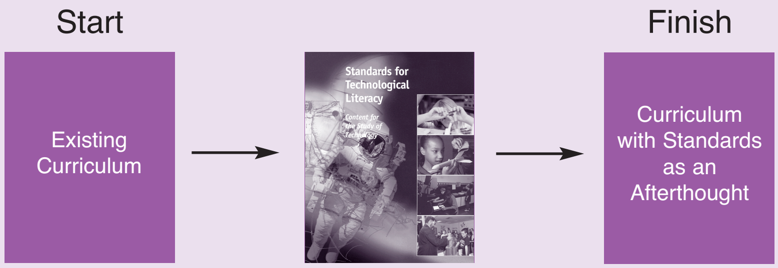
Figure 3. Standards-Based vs. Standards-Reflected Curricula

Standards-Based Curriculum



Correct: Begin by identifying specific content standards and benchmarks from *STL* to be addressed and build the curriculum based on those standards and benchmarks, incorporating existing curriculum elements as appropriate.

Standards-Related Curriculum



Incorrect: Keep existing curriculum and check off standards from *STL* to verify that they have been addressed in the curriculum.

It is strongly recommended that curriculum for the study of technology not be *standards-reflected.*

SECTION 2

Table 1 provides another example of how the concepts of standards-based and standards-related compare. This table is specific to student assessment, but as will be explained in Section 3, curricula and student assessment are very closely interconnected.

Table 1. Comparison of Standards-Based Student Assessment with Standards-Reflected Student Assessment

Standards-Based Student Assessment	Standards-Reflected Student Assessment
1. Identify *STL* standards and benchmarks to serve as basis for the content to be assessed. 2. Consider *AETL* standards and guidelines. 3. Define assessment criteria—"what a student should look like." 4. Develop lessons or activities to deliver *STL* content. 5. Identify assessment tools or methods that will deliver content in a manner consistent with *AETL*. 6. Gather evidence of student learning, using the selected assessment tool or method.	1. Start with a lesson or activity. 2. Identify the content being delivered by the lesson or activity. 3. Identify *STL* standards and benchmarks that might align with the lesson or activity content. 4. Select assessment tools or methods. 5. Consider how the selected tool or method addresses *AETL* standards.
Result: Student assessment that measures technological literacy consistent with *STL* & *AETL*.	**Result:** Student assessment that measures technological literacy when a "match" can be made between the lesson content and *STL* standards.

Five Fundamental Planning Questions in Standards-Based Curriculum Development

Where are we now?

Teachers and other curriculum developers need to examine how a specific curriculum facilitates technological literacy in classrooms, schools, or school districts. In other words, *What is the current state of the curriculum? Is the curriculum based on technological literacy standards? What is the current level of student technological literacy in the laboratory-classroom?* Appendix F is a checklist that can be used to analyze the current state of a curriculum in relation to technological literacy standards.

Where do we want to go?

The teacher or other curriculum developer must identify the outcomes they want from teaching and learning—*what should students who encounter this curriculum know and be able to do related to technology?* The standards to which a school or school district is committed can answer this question and may include national, state, and/or local standards. *STL* and *AETL* are the only nationally-accepted sets of educational standards for technological literacy. *STL* "is not a curriculum . . . teachers [and other curriculum developers] should use

STL as a guide for developing appropriate curricula, but the standards do not specify what units, lessons, or activities should go on in the laboratory-classroom" (ITEA, 2000, p. 13). *Planning Learning* asserts that curricula should be aligned with *STL (*AETL *Program Standard 1, Guideline A)*.

How are we going to get there?

In addition to showing that specific standards are being addressed, teachers and other curriculum developers have to consider the strategies they will use to advance student technological literacy. They need to consider how big ideas will be extracted from the standards and how they will be organized. The answer is a standards-based approach that integrates the curriculum, teaching, learning, and student assessment. An example of such an approach is presented in Section 3. *Planning Learning* is primarily intended to help teachers and other curriculum developers "get there."

What knowledge and abilities must educators possess to get there?

Professional development helps educators "get there" by providing opportunities based on the needs of students. Curriculum developers who are not actively working in the school system should also seek appropriate professional development in technology if they plan to develop curricula for technological study. (Appendix D contains a listing of the professional development standards from *AETL*.) Teachers should seek multiple opportunities to engage in comprehensive and sustained personal professional growth, such as action research, case discussions, internships, mentoring, partnerships, participation in professional organizations, and workshops and seminars (ITEA, 2005a). In other words, technology teachers and other technology curriculum developers need to remain current with the changing nature of technology and research in education.

How will we know when we have arrived?

Teachers and other curriculum developers will know that they have arrived when student assessment data show that students have achieved the content standards addressed by the curriculum in which they engaged. If students do not perform well, teachers know that they need to evaluate the technology program, including <u>but not limited to</u> curricula, and make revisions. Evaluation data could include data from student assessment. This could be either formative (on-going) or summative (at the end of a unit, course, or program). Additionally, evaluation data can be derived from curricular data; content data (*STL*); professional development data; data from the learning environment; instructional data; and other pertinent data that may be useful to program evaluation. Both successes and failures should be reported to program stakeholders. The goal is for <u>all</u> students to achieve technological literacy. Section 4 of *Planning Learning* outlines suggestions for teachers and other curriculum developers to consider as they evaluate curricula.

Teachers and other curriculum developers will know that they have arrived when student assessment data show that students have achieved the content standards.

***Evaluation* refers to the process of collecting and processing information and data to determine how well a design meets the requirements and to provide direction for improvements. For purposes of clarification in *Planning Learning*, as in the other addenda documents, the term *assessment* is only used to refer to <u>student</u> assessment.**

Teacher Story

Moving from Standards-Reflected to Standards-Based Curricula
In a Transnational Classroom
Thomas Loveland, Ph.D.

Prior to the release of ITEA's *Standards for Technological Literacy* (*STL)* in 2000*,* I worked with a Japanese teacher, Yoshitaka Hirayama, on a collaborative endeavor called the Japan-Florida Teens Meet Project (JFTMP). JFTMP was designed to help my American technology education students develop connections with students from a Japanese high school. The purpose, in addition to technological literacy, was to increase global awareness and respect for other cultures.

When the technology content standards in *STL* were released, I evaluated the JFTMP curriculum to see how it was meeting the standards. After carefully reading articles in different professional publications, I realized that I was looking at the standards incorrectly. My initial use of them was as a check-off list, which caused the JFTMP curriculum to be "standards-related" [see pp.10–12] After attending two presentations by ITEA Standards Specialists[3] Steve Shumway and Elazer Barnette, I learned that to utilize the standards correctly and to assure that our curriculum was standards-based, it was important to use them in four specific steps.

Step 1. First, in conjunction with state and district standards, pick the standards or outcomes you want your students to master from your class or project. Step back and look at the bigger picture to decide how that standard will tie into your program and decide what it is that you want students to know and be able to do.

Step 2. Second, pick an assessment strategy or strategies to check that your students have mastered the standard. Determine how you will know that students have learned the standard.

Step 3. Third, pick the big topic or area of technology you'll address.

Step 4. Finally, based on available resources, write the unit, daily lesson plans, and activities.

This curriculum development process is different from what most of us were taught. In the past, we looked at our own background, skills, and available resources to write student activities. Curriculum standards were checked off and listed with all lesson plans.

[3] ITEA has organized a cadre of educators who are trained on the content and implementation of the standards documents. They are available to provide workshops at all levels of the program (e.g., local, state). Inquire by e-mail to itea@iris.org.

Yoshitaka Hirayama, my collaborator from Mie Yume Gakuen High School, and I went back to the drawing board to write standards-based curriculum for JFTMP for the upcoming school year. We chose Standard 6, "Students will develop an understanding of the role of society in the development and use of technology" (ITEA, 2000/2002), as our focus. The three benchmarks (H, I, and J) focus on different cultures and technologies; development decisions; and factors affecting designs and demands of technologies. I tied these into Florida's Technology Education Curriculum Standards for my course, Advanced Applications in Technology. In this course, students work in teams to design, engineer, manufacture, construct, test, redesign, test again, and then produce a finished "project." JFTMP allowed the students to experience a broader definition of what teaming is, modeled on team concepts used by multi-national corporations.

After this first step, we worked on assessment strategies that could be used in Florida and Japan. This proved to be a challenge. We decided to have the students write journal entries to document their work on design, their cooperation as transnational team members, and their project management. In addition, we wanted the students to demonstrate a technological project from design to completion. We chose the big topic of aerospace as our third step. With the National Aeronautics and Space Administration close by at Kennedy Space Center, this was a natural topic that would interest students in both countries.

Finally, via teleconference, Yoshitaka and I worked on the unit, lesson plans, and class activities. We decided to have the students design and construct a scale-model International Space Station (ISS) that would have a sustainable environment for teenage astronauts. Some of the key activities in this project were having the students communicate via e-mail and live teleconferences to develop their plans; conduct research about space construction and sustainable living environments in space; practice with international conversions of time, measurements, and currency; and build team Powerpoint® and web presentations about module units on the space station. Five mixed groups were formed with Japanese and American teenagers to design and construct five crucial ISS modules: living quarters, water and plants, experiments, control systems, and solar power.

After the research and design phases were complete, the students began construction of the scale-model space station using bulk balsawood strips. This activity took about six months to complete. As in the real world, there were delays due to student absences, loss of materials, and other classroom activities. Amazingly, student interest in the project remained high. The live teleconferences were well attended. Lifetime friendships were formed. The Powerpoint® presentations were displayed during a live teleconference that was attended by two hundred Japanese students from a local middle school. They were taking notes and asking questions of the student team members.

Finally, in July of that year, eight of my technology education students accompanied me to Japan to visit our sister school. The space station components were shipped ahead. The components were officially linked together as part of a big media event. The Japanese students had painted beautiful pictures of Japanese scenery on the solar panel wings. Pictures of this event and of the space station may be found at the official JFTMP website, http://www.tcp-ip.or.jp/~hirayama/jftmp.

In 2003, ITEA released the next three sets of standards in *AETL* for student assessment, professional development, and programs. JFTMP had met the first two guidelines for Standard P-4: Technology program learning environments will facilitate technological literacy for all students. The two guidelines are A) Create and manage learning environments that are supportive of student interactions and student abilities to question, inquire, design, invent, and innovate, and B) Create and manage learning environments that are up-to-date and adaptable.

In creating and sustaining JFTMP, the co-directors felt that technological literacy standards should be for all students, not just Americans. By placing our students in transnational work teams, we created an environment that taught the students to think outside of the box and be respectful of other viewpoints. JFTMP has gone on to create dramatic anti-tobacco video dramas in Japanese and English and is currently preparing for its fifth year of activities, all based on *STL*.

Dr. Thomas Loveland taught Advanced Applications in Technology and TV Production at Marchman Technical Education Center in New Port Richey, Florida. He is co-director of JFTMP and presented with Mr. Hirayama about their collaboration at the ITEA Atlanta Conference in 2001. He can be reached at loveland.thomas@spcollege.edu.

Revising Existing Curricula

The steps presented in Section 3 of *Planning Learning* are ideal for developing new curricula. But **they can also be used to revise existing curricula to make it standards-based**. Any curricula that were developed prior to the development of technological literacy standards, for example, cannot be standards-based and should be revised. The vision for a standards-based curriculum must also take into account the concept of interdisciplinary connections with other content areas. The primary reason for this is that the study of technology is inherently cross-curricular in nature. While the primary responsibility for developing technological literacy in students lies with the technology teacher, other content areas can provide valuable assistance in the overall delivery of technological literacy throughout the school.

To modify an existing curriculum, those responsible for it must have a strong desire to become standards-based. This means that the curriculum will have to change, and the people responsible must be agreeable to accept change in this process. For example, an existing lesson or activity may be modified and used in a standards-based unit or lesson. Existing course reference materials such as modules, textbooks, audio-visual materials, computer programs, or Internet sites could be used in the newly-developed standards-based curriculum. Incidentally, there are some excellent new standards-based textbooks being developed now by a number of publishers.[4] Instructional strategies utilized in the previous existing curriculum could still be very appropriate for the standards-based curriculum. Facility design should be taken into consideration for the new standards-based curriculum; however, there may be elements from the existing curriculum that are still relevant and apply. Finally, course evaluation should be implemented in any curriculum, regardless of whether it is standards-based.

Aligning curriculum with *STL* may seem like a difficult job at first. But the vision that all students can become technologically literate makes this a worthy effort. All educators who are involved with technology curriculum development must have a unified conviction to base future curriculum on technological literacy standards. Those who profess this conviction will become the leadership necessary to instigate support for change to not only curricula, but also the larger picture of the technology program, if necessary.

Nationally-developed content standards in other academic areas include (but are not limited to):

- ***National Science Education Standards*** **(NRC, 1996)**
- ***Benchmarks for Science Literacy*** **(AAAS, 1993)**
- ***Principles and Standards for School Mathematics*** **(NCTM, 2000)**
- ***Geography for Life: National Geography Standards*** **(GESP, 1994)**
- ***National Standards for History*** **(NCHS, 1996)**
- ***Standards for the English Language Arts*** **(NCTE, 1996)**
- ***National Educational Technology Standards for Students: Connecting Curriculum and Technology*** **(ISTE, 2000).**

[4] ITEA, Corwin Press, and the National Science Teachers Association (NSTA) have co-published a resource that examines over 25 nationally available curricular materials and identifies over 100 informal resources. It is also intended to be a tool for reviewing other products (see Britton, De Long-Cotty & Levenson, 2005).

SECTION 3

Standards-Based Curriculum Development or Revision

This section includes a comprehensive, multi-step process for developing and revising curricula.

This section of *Planning Learning* presents a step-by-step approach to standards-based curriculum development. The term *curriculum* may take on a broad or narrow focus depending on its use. In this section, it refers to the written plan in which the content from *Standards for Technological Literacy: Content for the Study of Technology* (*STL*) (ITEA, 2000/2002) is defined, arranged, ordered, and emphasized within a course of study (e.g., units within a technology course). It is recommended that teachers and other curriculum developers follow all steps, not eliminating any, in developing a standards-based technology curriculum.

It should be noted that while it may be necessary for an individual teacher to develop curricula for his/her own classroom, curricula are often effectively developed as part of a team effort. For example, a "design" team might be used to generate a draft of the curriculum. Teachers and other curriculum developers would then refine the curriculum draft expanding the ideas into units and lessons. This process of revision and refinement might involve one individual or multiple individuals.

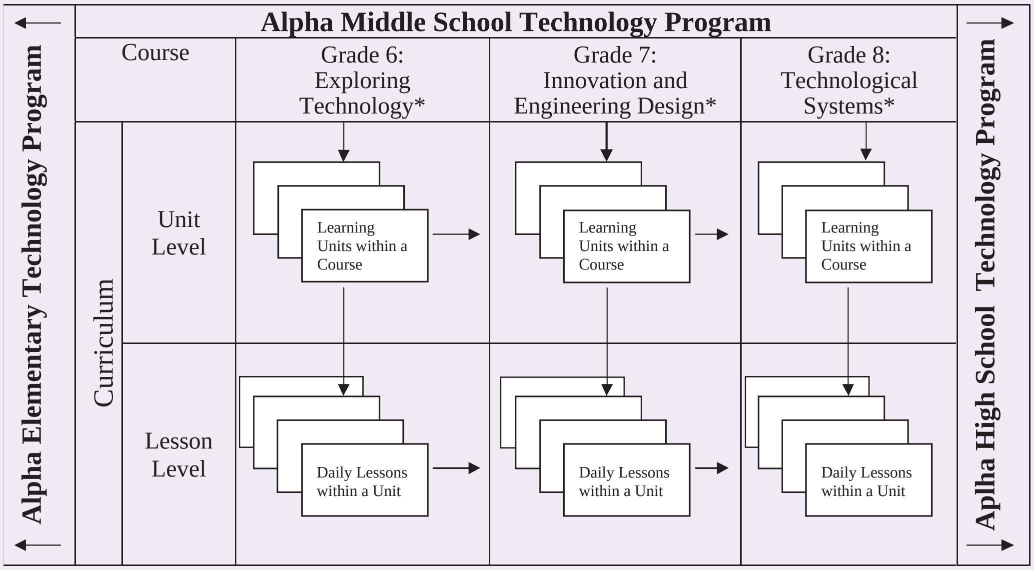
The written curriculum for an entire course will describe how the standards-based goals and objectives of the course will become translated into units and daily lesson plans.

First, it is important for users of this approach to understand the hierarchy of courses, units, and lessons within a technology program. As explained in Section 1, program encompasses everything that affects student learning *implemented across grade levels*. For example, a middle school technology program might look like Figure 4. Notice that under each course title, there are smaller bodies of learning called *units*, which typically last from a few days to a few weeks. Within each unit are daily *lessons*, which describe how learning will take place in the classroom on a day-by-day basis.

The written curriculum for a single unit will describe how the standards-based goals and objectives of the unit will become translated into daily lesson plans.

The written curriculum for an entire course describes how the standards-based goals and objectives of the course will become translated into units and daily lesson plans. Similarly, the written curriculum for a single unit will describe how the standards-based goals and objectives of the unit will become translated into daily lesson plans.

Figure 4. The Program-Curriculum-Course-Unit-Lesson Hierarchy



* ITEA-Developed Model Course Guides

The Curriculum Guide

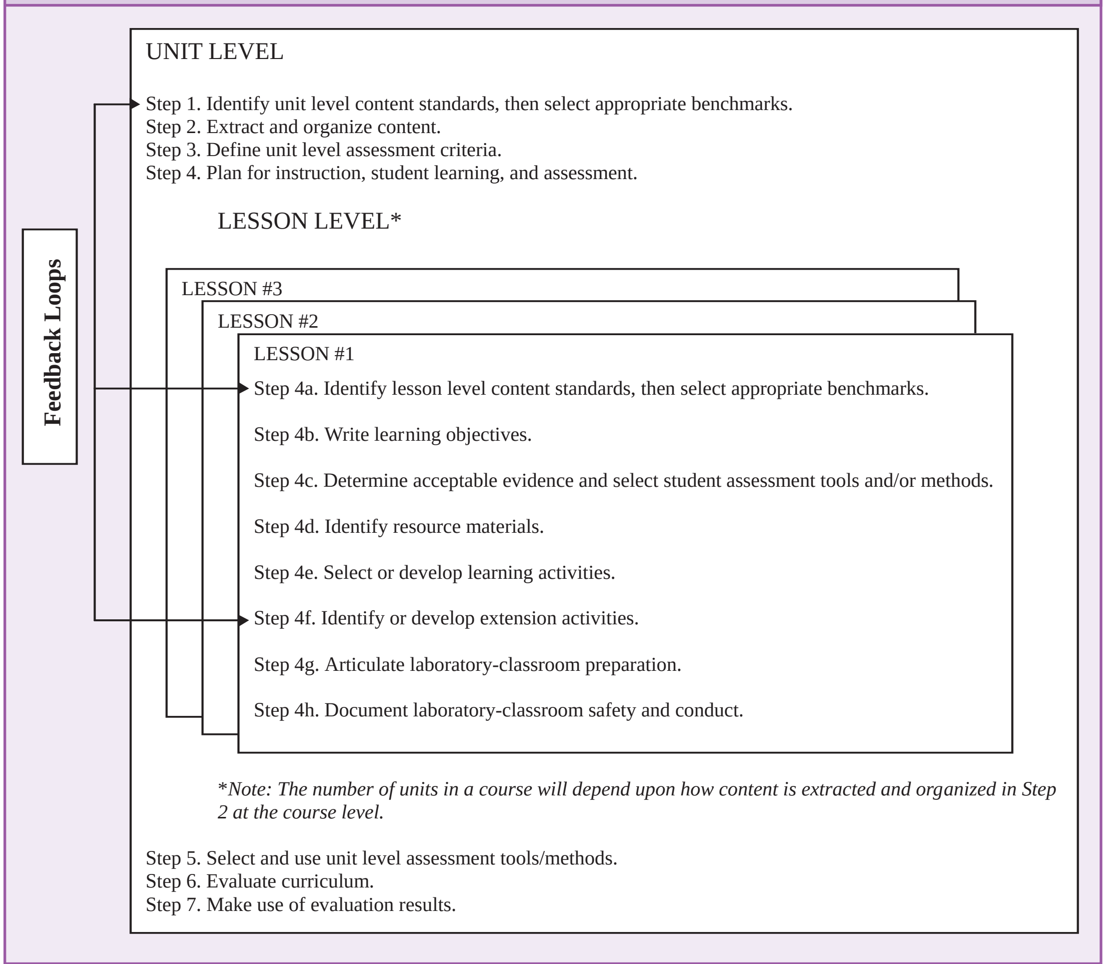
The *curriculum guide* is a written document that includes the curriculum as well as administrative details and elements of the bigger framework within which the curriculum will be delivered to students. The example provided in Figure 4 only details a middle school program, but a well-articulated program should have similar hierarchies designed for elementary and high school. If the curriculum is being written for an entire course, it will contain the name of the course and the standards and objectives that the course should address as well as such things as student assessment, resources, sample activities, and safety and conduct rules.

Developing a Standards-Based Curriculum

Figure 5 illustrates a step-by-step approach to standards-based curriculum development. The approach was developed by ITEA's Technology for All Americans Project staff during the process of writing the addenda document on student assessment, *Measuring Progress* (ITEA, 2004). A remarkably similar model was developed during the same approximate timeframe by Steve Shumway and Jared Berrett and their students during the course of revising the pre-service technology teacher education program at Brigham Young University (Shumway & Berrett, 2004). Both approaches profess to use a "modified backwards design;" that is, the developers used backwards design (Wiggins & McTighe, 1998) as the basis, but they modified it to account for the scale or level (program, course, unit) at which the process was applied.[5] These modifications are almost identical in the two approaches and serve, to some degree, to validate each other.

While the approach in Figure 5 presents seven steps, experienced teachers and other curriculum developers know that organizing curricula does not always occur in a linear fashion. As users of the approach become comfortable developing standards-based curricula, they will revisit and re-examine steps to help thoroughly link curricula to technological literacy standards.

Figure 5. Standards-Based Approach to Curriculum Development



[5] The writers have attempted to make this section of *Planning Learning* as inclusive as possible for the user. But because the curriculum development process is closely linked with the student assessment development process in this modified version of backwards design, a great deal more detail on the student assessment development process is available to users in the addenda document, *Measuring Progress* (ITEA, 2004).

Figure 5 illustrates how feedback loops may be incorporated into curriculum development or revision. At the lesson level, once the initial plan for student learning and assessment has been written in the form of daily lesson plans, a feedback loop allows the user to go back and reconsider what additional standards and benchmarks might be effectively covered in the lesson and/or unit. These feedback loops were added to ITEA's model after an examination of the modified backwards design model developed at Brigham Young University (Shumway & Berrett, 2004).

It is important to note that the steps at the course level are essentially identical to the steps at the unit level. A *unit* is an organized series of lessons that focuses on a specific topic. Step at the lesson level change somewhat, as lessons go into great detail. Also the lesson level steps are closer to a more traditional representation of backwards design. A *lesson* defines cognitive content, individual learning activities, lectures, projects, and other teaching strategies for delivering content day-by-day in the laboratory-classroom.

A *course* is a series of units that lasts for a specified time (semester, year, etc.) and is designed around a specified school subject.

A *unit* is an organized series of lessons that focuses on a specific topic and typically lasts from a few days to a few weeks.

A *lesson* defines cognitive content, individual learning activities, lectures, projects, and other teaching strategies for delivering content day-by-day in the laboratory-classroom.

The standards-based approach to curriculum development presented here incorporates the backward design concept (Wiggins & McTighe, 1998). Comparison with the backward design process outlined by Grant Wiggins and Jay McTighe may reveal a seeming discrepancy in the order of Steps 2–4. However, there is little discrepancy, as the Wiggins and McTighe process is applied on a smaller scale, at the level of designing individual assessment instances, whereas the approach put forth in *Planning Learning* enables those individual assessment instances to be based upon the overall assessment criteria for the course or unit.

If you are writing curricula for an entire course, please photocopy Appendix H and fill in pages 1-4. This information should have been developed at the program level of planning by a committee composed of teachers, administrators, and other stakeholders. Directions are provided on the forms with references for further assistance. Of primary importance is the Responsibility Matrix Form (see Appendix G), which identifies the technology content standards and other content standards that need to be addressed throughout the course. This form will become a primary reference for building units within the course.

The rest of this section will lead you through the steps to complete the approach in Figure 5 for a single unit using the form provided in Appendix I. Before moving on to the curriculum steps that follow, it is necessary for you to decide at what level you will be writing curricula. While the approach described in this section will take you through the development of a single unit, the workbook in Appendix H is appropriate for those working to develop multiple units for an entire course, and the workbook in Appendix I is appropriate for those who are only building a single unit. **If you are writing curricula for a single unit, please photocopy Appendix I and fill in page 1.**

Additionally, a vignette is embedded within the text to provide a "snapshot" of how a teacher or other curriculum developer might apply the standards-based approach to curricula. Please see page 26 for an example.

Step 1: UNIT LEVEL—Identify Content Standards, Then Select Appropriate Benchmarks

Standards-based curriculum development begins with technological literacy standards. Teachers and other curriculum developers begin the development process with a clear picture of what they want students to learn. The standards in *STL* emphasize what every student should know and be able to do in order to be technologically literate. A standards-based curriculum is planned to develop student understanding consistent with the standards and benchmarks in *STL* across grade levels. The curriculum should not be considered apart from the technology program; the curriculum is a component of the technology program. It is therefore necessary for teachers and other curriculum developers to identify how the curriculum they are developing fits into the overall program.

Note: Standards and benchmarks chosen at the unit level are selected from those that were identified at the course level.

Directions: Identify the standards that will be addressed in the unit. Then select the benchmarks that provide further detail for your unit. Record the standards and benchmarks on page 5 of Appendix H (if you started working at the course level) or page 2 of Appendix I (if you started working at the unit level).

If you are writing the unit for a specific course, you will choose standards and benchmarks primarily from the Responsibility Matrix Form (Appendix G) for that course. You may take this opportunity to group all of the standards and benchmarks from the Responsibility Matrix Form into multiple units, which you will develop one-by-one. Alternatively, you may choose to simply extract those standards and benchmarks that apply to a specific unit you would like to develop.

If you are developing a unit independent of a specific course, you will select standards and benchmarks appropriate to the grade level for which the unit is designed. Remember, it is not necessary to address all 20 standards in any given lesson or unit. However, it is necessary to ensure that for each grade “band” (K–2, 3–5, 6–8, or 9–12) students encounter the content defined by all 20 of the *STL* standards and their accompanying benchmarks within that band.

The goal is to meet all of the standards through the benchmarks. ITEA does not recommend that teachers and other curriculum developers eliminate any of the benchmarks over the K–12 experience; however, they may find it desirable to add additional benchmarks.

Vignette

Snapshot of the Approach in Action

Note: *The vignette is intended to provide a snapshot of the approach taken to align curricula with technological literacy standards. It provides examples. It does not provide a comprehensive examination of each step.*

Ms. Toledano, a 6th grade technology teacher, is interested in aligning curricula in her laboratory-classroom with technological literacy standards. She began the process at the program level, by working with other teachers to identify the grade levels at which individual standards will be taught and assessed. Using the Responsibility Matrix Form (Appendix G in *Planning Learning)*, she developed a matrix to document teacher responsibilities for addressing the content standards in *STL* as well as related content standards in other disciplines. She used this matrix to plan curricula for the course, and is now ready to begin developing curricular units.

In planning her first curricular unit, Ms. Toledano reviews the standards that will be addressed in the course and consults *STL* to identify the content standards she will address in her unit. She looks to the benchmarks for further detail. Ms. Toledano records the standards and benchmarks she intends to teach and assess in her course on page 2 of her Unit Level Curriculum Development Workbook (see Figures 6 and 7).

APPENDIX I

Unit Level Curriculum Development Workbook
Page 2

UNIT LEVEL—Identify Standards, Then Select Benchmarks

Directions: Identify the standards that will be addressed in the unit. Then select the benchmarks that provide further detail to your unit. It is generally recommended that you address no more than two or three standards in each unit. It is necessary to consider national, state/provincial/regional, and school district technological literacy standards as well as standards in other subject areas.

UNIT TITLE: Forensic Medicene

Standard(s): STL 6. Students will develop an understanding of the role of society in the development and use of technology.

Figure 6

Benchmark(s): Benchmark D. Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies..

Figure 7

Step 2: UNIT LEVEL—Extract and Organize Content

As detailed as the benchmarks are, they may need additional interpretation. From the benchmarks, you will need to identify the "big ideas" that students should learn to ultimately achieve the standards and benchmarks in *STL*. This may require you to group concepts together or to extract specific ideas from the benchmarks. These big ideas are the key threads that bind the unit together with the student assessment methods, lesson plans, and activities. Once the big ideas have been identified, you will need to define the objectives for the unit. Consider these questions as you try to identify unit objectives:

- What are the specific understandings students should possess as a result of this unit?
- What should students know coming into this unit?
- What connections can be made to future units?
- What affective and psychomotor aspects should students achieve as a result of this unit?

> Directions: Record the big ideas that will be addressed in the unit on page 5 of Appendix H (if you started working at the course level) or page 2 of Appendix I (if you started working at the unit level). Take this opportunity to further articulate the specific understandings and abilities students will gain by defining unit objectives. Record the unit objectives on page 5 or page 2.

Vignette, *Continued*

Ms. Toledano has already completed Step 1 of her curricular unit development by identifying standards and benchmarks that will be addressed in the unit on forensic medicine. To complete Step 2, Ms. Toledano extracts the important understandings from the standards and benchmarks she selected. She records these big ideas on page 2 of her Unit Level Curriculum Development Workbook, and proceeds to write objectives based on the big ideas (see Figures 8 and 9).

UNIT LEVEL—Extract and Organize Content

Directions: Identify the big ideas that students should learn to ultimately understand the standards and benchmarks selected for this unit.

Big Idea(s): *1. DNA technologies available for use today provide greater efficiency and accuracy than previously used technologies.*

2. Economic, political, and cultural issues influence the selection and use of technologies for forensic investigation..

Figure 8

Unit Objective(s):

At the completion of this unit, students will be able to… *1. Understand the relation and application of DNA technologies for legal purposes.*

Figure 9

Step 3: UNIT LEVEL—Define Assessment Criteria

Assessment criteria are indicators that suggest the level of understanding attained by students. Assessment criteria provide the basis for teaching and learning by capturing the essential ingredients of the content being measured. They are written to provide cues to you and your students about what significantly indicates student technological literacy. **Detailed units/lessons, instruction, assessment tools and methods, and the learning environment are developed *after* assessment criteria have been established and are based on the assessment criteria.**

As assessment criteria are established, we must consider that student learning will be influenced by a variety of factors including student commonality and diversity—interests, cultures, abilities, socio-economic backgrounds, and special needs. To allow for student commonality and diversity and the reality that all students will not attain a consistent level of understanding all of the time, we must delineate assessment criteria at varying levels to accurately assess student progress toward technological literacy (ITEA, 2004).

***Assessment criteria* are expectations for student learning. They define what a student should know, understand, and be able to do and can be measured and/or observed.**

Directions: To write the assessment criteria, begin by examining the big ideas. Ask yourself, *what questions should my students be capable of answering upon completion of this lesson/unit?* This might be considered the acceptable or "at target" level or "standard level" of understanding. Then specify criteria for learning that exceed your expectations, or are "above target." And finally define criteria that do not meet your expectations or are below your expectations, which might be considered "below target." Thus, the assessment criteria will be written for at least three levels of understanding. Record the assessment criteria on one of the sample matrices provided on pages 6–8 of Appendix H (if you started working at the course level) or pages 3–5 of Appendix I (if you started working at the unit level), or develop one of your own.

Vignette, *Continued*

Ms. Toledano is ready to complete Step 3 for her unit on forensic medicine. Examining the big idea, "DNA technologies available for use today provide greater efficiency and accuracy than previously used technologies," she establishes and records assessment criteria on page 3 of her Unit Level Curriculum Development Workbook (see Figure 10). She categorizes the levels of understanding as "above target," "at target," and "below target."

Note: *The form below provides only one example of assessment criteria appropriate for Ms. Toledano's unit. A fully-developed form would likely contain more assessment criteria.*

APPENDIX I

Unit Level Curriculum Development Workbook

Page 3

UNIT LEVEL—Define Assessment Criteria

What are the expectations for student learning? Define criteria at levels which meet, exceed, and fall below your expectations. Defining assessment criteria at various levels requires that you first determine the number of levels that will be assigned. You may choose to use any of the three tables that follow or develop one of your own.

Big Idea/Unit Objective	Assessment Criteria		
	Below Target	**At Target**	**Above Target**
DNA technologies available for use today provide greater efficiency and accuracy than previously used technologies.	*Identification of DNA technologies currently in use for forensic investigation.*	*Identification of DNA technologies currently in use for forensic investigation compared with those available 15 years ago.*	*Identification of DNA technologies currently in use for forensic investigation compared with those available 15 years ago. Evidence of research of DNA technologies to be available in the future.*

Figure 10

Step 4: UNIT/LESSON LEVEL—Plan for Instruction, Student Learning, and Assessment

Now that you have defined the overall standards, benchmarks, big ideas, and assessments at the unit level, you need to engage students in learning to develop the desired understandings. We turn our attention to the specific learning opportunities, instruction, and assessment to be provided at the lesson level.

Step 4a: LESSON LEVEL—Identify Content Standards, Then Select Appropriate Benchmarks

Standards emphasize what every student should know and be able to do in order to be technologically literate. Benchmarks "uncover" the concepts necessary for developing an understanding of the standards.

Note: Standards and benchmarks chosen at the lesson level are selected from those that were identified at the unit level in Step 1.

Directions: Refer to the standards and benchmarks that were selected at the unit level. (See page 5 of Appendix H or page 2 of Appendix I.) Select the standards that will be addressed in this lesson. Then select the benchmarks that provide further detail to the lesson. Record these standards and benchmarks on page 9 of Appendix H (if you started working at the course level) or page 6 of Appendix I (if you started working at the unit level).

Note: At the lesson level, one standard may be selected or multiple standards may be selected. When combined, all of the lessons in a unit will cover all of the standards and benchmarks identified for the unit.

Vignette, *Continued*

Ms. Toledano is ready to proceed with Step 4a of her curricular unit development process: Plan for Instruction, Student Learning, and Assessment. Examining the big ideas and unit objectives she recorded on page 2 of her Unit Level Curriculum Development Workbook, she decides to write a lesson on "The Use of DNA Technology in Popular Television." She fills in page 6 of her Unit Level Curriculum Development Workbook, selecting standards and benchmarks from the ones she recorded at the unit level on page 2 of her Unit Level Curriculum Development Workbook (see Figure 11).

Note: *The form below provides only a few examples of each element of the lesson and are not intended to represent a lesson in its entirety.*

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Unit Level Curriculum Development Workbook
Page 6

NOTE: You will need a copy of pages 6-10 for each lesson that is developed.

Plan for Instruction, Student Learning, and Assessment

Specify Lesson Duration: *1 Day*

LESSON LEVEL—Identify Standards, Then Select Benchmarks

Directions: Identify the standards that will be addressed in the lesson. Then select the benchmarks that provide further detail to your lesson. Refer to the standards and benchmarks that were identified for the unit on Page 2 of this workbook.

Standard(s) and Benchmark(s): *STL 6. Students will develop an understanding of the role of society in the development and use of technology. Benchmark D. Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies.*

Figure 11

Step 4b: LESSON LEVEL—Write Learning Objectives

The lesson objectives clarify the intent of the lesson by defining what students should look like as a result of learning. Teaching and learning should incorporate cognitive, affective, and psychomotor learning elements. Write lesson objectives that define what students should know, be able to do, and understand related to the big ideas being developed in the unit.

> Directions: Answer the following questions:
>
> - *What are the specific understandings students should possess as a result of this lesson?*
> - *What should students know coming into this lesson?*
> - *What connections can be made to future lessons?*
> - *What does a teacher do if a student already knows the content?*
> - *What will a teacher do if a student doesn't learn the content?*
> - *How will the teacher know if the student has learned the content?*
>
> Write lesson objectives that define what students should know, be able to do, and understand as a result of the lesson. They should be specific, measurable, and timely. Be sure to include suitable cognitive, affective, and psychomotor learning elements. Record these on page 9 of Appendix H (if you started working at the course level) or page 6 of Appendix I (if you started working at the unit level).

SECTION 3

Vignette, *Continued*

Ms. Toledano starts Step 4b of her curricular unit development process by writing learning objectives for her lesson on page 6 of her Unit Level Curriculum Development Workbook (see Figure 12).

LESSON LEVEL—Write Learning Objectives

Directions: Identify the intent of learning. Write lesson objectives that define students should know, be able to do, and understand as a result of the lesson. Be sure to include suitable cognitive, affective, and psychomotor learning elements.

Students will:

1. *Use popular television shows to see how forensic medicine uses DNA techniques to solve crimes.*
2. *Perform a hands-on activity to investigate DNA mapping.*

Figure 12

Step 4c: LESSON LEVEL—Determine Acceptable Evidence and Select Student Assessment Tools and/or Methods

Determine what is sufficient evidence to judge whether or not students have developed the desired understandings. How will you know if students have achieved the desired results and met the learning objectives? What will be accepted as evidence of student understanding and proficiency? Student assessment should be based on "Student Assessment Standards" (chapter 3) of *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* (*AETL*) (ITEA, 2003). *Measuring Progress: A Guide to Assessing Students for Technological Literacy* (ITEA, 2004) is a resource for teachers to use as they plan and implement standards-based student assessment.

SECTION 3

> Directions: Determine what is sufficient evidence to judge whether or not students have attained the desired understandings. You will need to use a variety of assessment tools and methods to accurately determine student understanding. Selection of individual assessment tools and methods is based on the content, the purpose, and the audience for assessment results. Record these on page 9 of Appendix H (if you started working at the course level) or page 6 of Appendix I (if you started working at the unit level).

Note: A student's evidence of understanding deals with more than tests or completed projects. Ongoing formative assessment (e.g., observation, "talking" with the student, etc.) must be considered to help provide a total picture of student understanding and ability.

Vignette, *Continued*

Ms. Toledano begins to select the tools and methods she will use to assess her students. She consults *Measuring Progress* (ITEA, 2004), and she records her assessment tools and methods on page 6 of her Unit Level Curriculum Development Workbook.

LESSON LEVEL—Select Student Assessment Tools and/or Methods

Directions: Determine what is sufficient evidence to judge whether or not students have attained the desired understandings. Evidence refers to the information that is intended to demonstrate or prove a level of understanding.

1. An activity report will be included in each student's portfolio for the unit.

Figure 13

Step 4d: LESSON LEVEL—Identify Resource Materials

Resource materials will provide you with the background information for developing your lessons. You will want to select reference materials that provide you with the necessary information to detail the content of the standards and benchmarks selected for the lesson.

> Directions: Find up to three print-based materials (e.g., textbooks, manuals, etc.), two audio/visual materials (e.g., videos, DVDs, cassette tapes, compact discs, etc.), two computer-related programs, and five Internet sites that detail the content for the lesson. Record these on page 10 of Appendix H (if you started working at the course level) or page 7 of Appendix I (if you started working at the unit level).

Vignette, *Continued*

On page 7 of her Unit Level Curriculum Development Workbook, Ms. Toledano records the resource materials she plans to use (see Figure 14).

LESSON LEVEL—Identify Resource Materials

Directions: List the resource materials that you will use to develop lesson activities.

• Print-Based Sources (up to three)

1. *Simpson's Forensic Medicine by Bernard Knight, 1997*

Figure 14

Step 4e: LESSON LEVEL—Select or Develop Learning Activities

Plan instructional and learning experiences to inform students and help them enhance their technological literacy. You have defined your expectations for student learning by specifying the evidence that will judge whether or not students have developed the desired understandings. What knowledge (facts, concepts, and principles) and skills (procedures) do students need to perform effectively? What activities will equip students with the needed knowledge and skills? Your answers to these questions will help you to identify the purpose of the lesson as well as your expectations of prerequisite knowledge and abilities. Additionally, you will need to specify the instructional strategies and learning activities you will use to advance student understanding.

Write the lesson to include the following components: rigor, relevance, questions, degree of innovation, sequence of content and process, grouping strategies, lesson extensions, and benchmark suggestions. Refer to the rubric in Appendix J for suggestions.

Directions: Identify a learning experience that students might complete in this lesson. Identify related resources and materials required in the learning experiences and comment on the instructional strategy (e.g., cooperative learning, modular instruction, problem solving, etc.) to be employed. Record this information on page 11 of Appendix H (if you started working at the course level) or page 8 of Appendix I (if you started working at the unit level).

On page 8, Ms. Toledano draws from all of the information she has recorded in her workbook to begin writing out the lesson (see Figure 15).

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Unit Level Curriculum Development Workbook

Page 8

LESSON LEVEL—Select or Develop Learning Activities

Directions: Fill in the information below to create your lesson plan. You will want to be specific about how you intend to engage students in learning.

Purpose of Lesson: *To explore the use of DNA technology.*

Required Knowledge and/or Skills: *1. Students should have read assignment (information about DNA) provided for homework.*

Lesson: *1. Lecture (20 Minutes): DNA Technology as part of forensic medicine (lecture includes 5 minute video clip of [a popular TV show].*

2. Activity (20 Minutes): Complete DNA activity, which includes

Figure 15

Step 4f: LESSON LEVEL—Identify or Develop Extension Activities

Beyond identifying specific learning activities, teachers and other curriculum developers might find it helpful to identify additional learning opportunities in which to engage students. These are often learning opportunities outside of the laboratory-classroom that connect classroom learning to everyday experiences. For example, as a community service project, the class could raise money and then design and construct a ramp at the home of someone with mobility problems. They could design and construct a storage shed and then later donate it to a construction site for Habitat for Humanity or another similar service organization. Teachers must observe the school system's policies on what students are allowed to do off campus.

Directions: Identify additional learning opportunities in which you might engage students if time allows or to extend their knowledge and abilities. Identify the number of days each experience will last. Record this information on page 12 of Appendix H (if you started working at the course level) or page 9 of Appendix I (if you started working at the unit level).

Vignette, *Continued*

Ms. Toledano nears completion of the lesson by filling out the potential extension activities on pages 9 and 10 of her Unit Level Curriculum Development Workbook. She has already begun thinking about the next lesson in the unit, and she has already made copies of the lesson portion of her workbook so she can begin writing it (see Figure 16).

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Unit Level Curriculum Development Workbook
Page 9

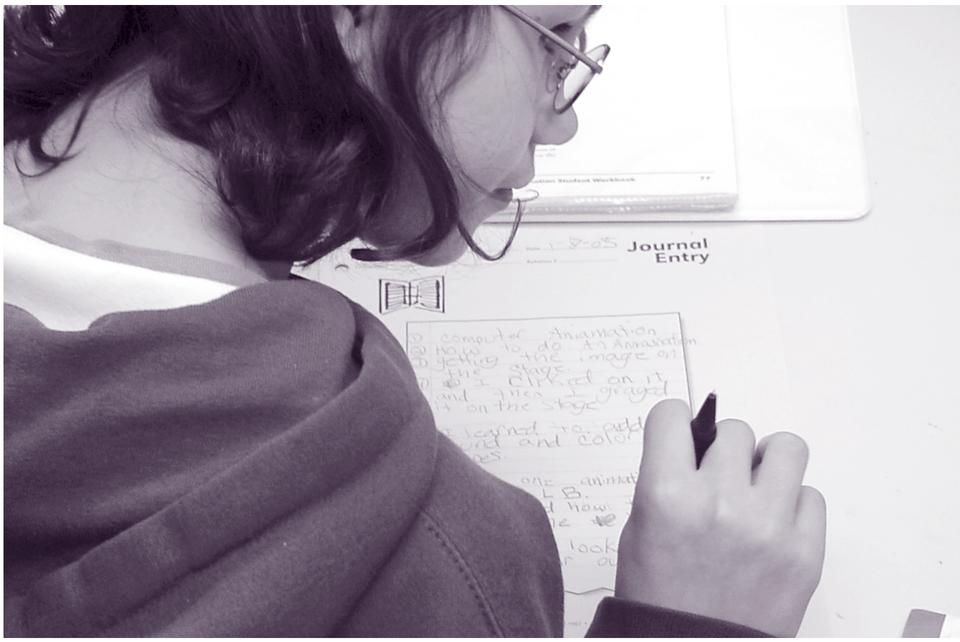
LESSON LEVEL—Identify or Develop Extension Activities

Directions: Identify additional learning opportunities in which you might engage students if time allows or to extend their knowledge and abilities.

Students may "solve a crime" using investigative techniques and forensic technologies.

Students will keep a log on DNA in their portfolios.

Figure 16



Step 4g: LESSON LEVEL—Articulate Laboratory-Classroom Preparation

Identify the learning environment suitable for learning the lesson content. Specify details of the laboratory-classroom design and list the required tools, materials, and equipment needed to guide the full implementation of the curriculum (see page 41 for vignette example).

> Directions: Identify the laboratory-classroom design and list the needed tools, materials, and equipment for effective implementation of the lesson. Record this information on page 12 of Appendix H (if you started working at the course level) or page 9 of Appendix I (if you started working at the unit level).

SECTION 3

Step 4h: LESSON LEVEL—Document Laboratory-Classroom Safety and Conduct

Schools and school districts typically have a student handbook that covers general student behavior, however, it is important to include both general safety and conduct rules in the curriculum guide as they relate to the curriculum content. Conduct rules define appropriate student behavior. It is important to insert these at the point at which they will be immediately applied (see page 41 for vignette example). Too often, safety is taught during the first three weeks of school and not applied until months later.[6]

> Directions: Identify the laboratory-classroom design and list the needed tools, materials, and equipment for effective implementation of the lesson. Record this information on pages 12–13 of Appendix H (if you started working at the course level) or pages 9–10 of Appendix I (if you started working at the unit level).

Note: This is the last step that corresponds with the workbook in Appendix I.

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[6] There is an acknowledged need for an additional addendum to cover the learning environment that incorporates issues of safety.

Vignette, *Continued*

Ms. Toledano completes her lesson by articulating laboratory-classroom preparation, safety, and conduct and recording her plans and expectations on pages 9 and 10 of her Unit Level Curriculum Development Workbook (see Figures 17 and 18).

LESSON LEVEL—Articulate Laboratory-Classroom Preparation

Directions: Identify the laboratory-classroom design and list the needed tools, materials, and equipment for effective implementation of the lesson.

Laboratory-classroom design:

Arrange classroom for lecture (first 20 minutes)

Allow students to work in pairs on DNA Lab Activity (25 minutes)

Tools/Materials/Equipment:

1. Safety Glasses

Figure 17

LESSON LEVEL—Articulate Laboratory-Classroom Safety and Conduct

Directions: List below important "general" safety rules that must be followed in this lesson. Safety rules can relate to tools, materials, equipment, and activities.

1. Wear Safety Glasses

2. No Horseplay

Figure 18

Step 5: Select and Use Unit Level Assessment Tools/Methods

The student assessment data that were collected at the lesson level may provide enough evidence to indicate that students have attained the standards and benchmarks selected for the unit. For example, perhaps the summative unit assessment tool for the unit is a portfolio of student work accomplished through the daily lessons. Teachers and other curriculum developers, however, must make decisions about what will constitute formative and summative assessment measures at the unit level. As *Planning Learning* focuses primarily on curricula, users are encouraged to seek resources for guidance on incorporating student assessment tools and/or methods into curricula in a way that is effective and standards-based. The student assessment standards in *AETL* are the only nationally-accepted standards about assessing students for technological literacy. The addendum to *AETL*, *Measuring Progress*, provides a great deal of information on the assessment process, and it is tied very closely to the information presented in *Planning Learning* about the curriculum development process. Remember, the backbone of the backwards design concept is that the curriculum development process relies upon the expectations for student assessment.

The backbone of the backwards design concept is that the curriculum development process relies upon the expectations for student assessment.

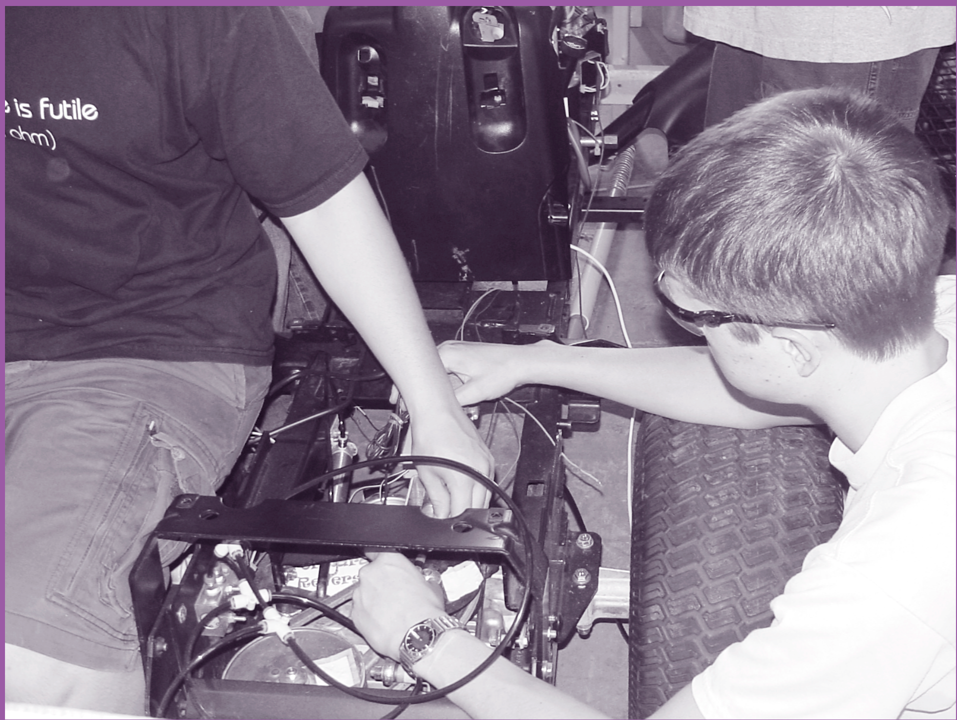
Step 6: Evaluate Curriculum

More detail on evaluation is presented in Section 4, but in general, users should consider that once the curriculum is developed, teachers and other curriculum developers will want to gather evidence to determine its effectiveness. This requires that the curriculum be implemented; however, **planning for evaluation should begin before implementation and be carried out during implementation**.Teachers and other curriculum developers will want to gather a variety of information. They will need to collect both student and teacher data. Curriculum evaluation will provide insight into the structure and organization of the curriculum as well as the content being taught and delivery mechanisms. How did students react to the units/lessons/activities? Were directions and/or instructions clear? Were students able to complete the lessons/activities with limited assistance from the teacher? Did the curriculum effectively develop student understanding? What do student assessment results indicate about the effectiveness of the curriculum? Section 5 of *Planning Learning* contains several suggestions for developing an evaluation process appropriate to the specific needs of those who will evaluate curricula.

Step 7: Make Use of Evaluation Results

Evaluation is an empty process unless the results are used to make positive change. Teachers and other curriculum developers use evaluation results to make decisions. Curriculum is evaluated for a variety of purposes, which are provided with some detail in Section 4.

SECTION 4
Evaluating Curricula



This section provides a general overview of the curriculum evaluation process.

Technology programs constantly change to reflect society and recent technological advances. Technology teachers and other curriculum developers need to evaluate all elements of the curriculum, systematically and continuously. Appendix K is a checklist that teachers and other curriculum developers can use to evaluate standards-based curriculum; however, users should be aware that there are many foundational aspects and principles that should be considered before engaging in curriculum evaluation. The standards in *Standards for Technological Literacy: Content for the Study of Technology* (*STL*) (ITEA, 2000/2002) and *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* (*AETL*) (ITEA, 2003) serve as a basis for evaluating technology curriculum.

Curriculum evaluation is important to ensuring the quality of technology programs for a number of reasons. These may include:

- Improving student technological literacy.
- Promoting technological studies.
- Informing key stakeholders of the condition of technological studies.
- Promoting adaptability for program enhancement.
- Improving public understanding of technological literacy and technological studies.
- Updating curricula.
- Ensuring funds.

Realizing Excellence (ITEA, 2005), the addenda document to _STL_ dealing with programs, recommends the formation of a Technology Program Committee and, as appropriate, a Technology Program Advisory Committee at the K–12 Technology Program level. In addition to participating in the planning and implementation process, these committees would also serve to direct and advise the evaluation and revision process of the program.

SECTION 4

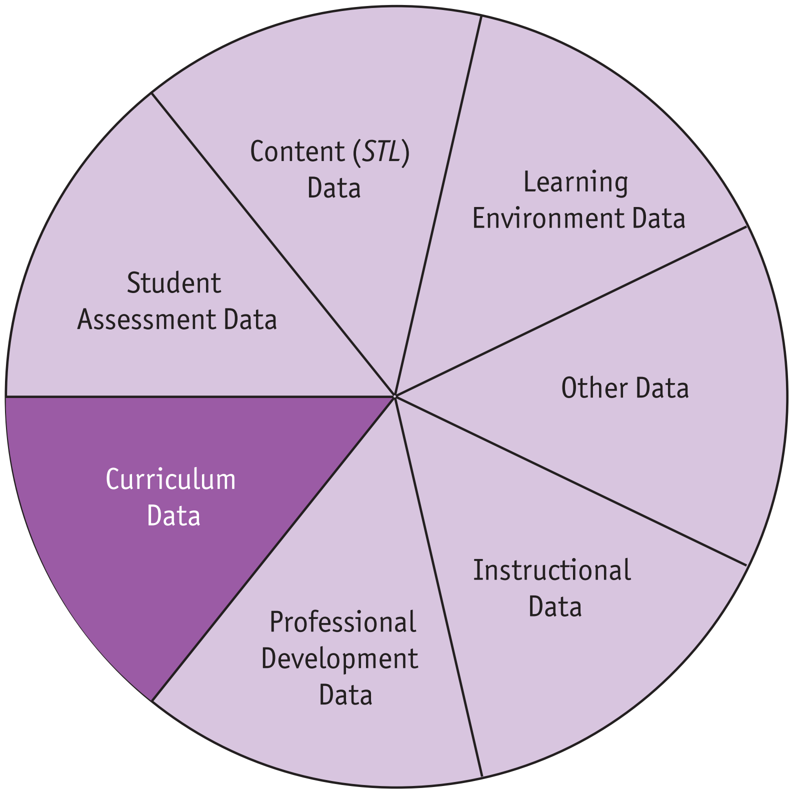
The Scope of Evaluation

Realizing Excellence (ITEA, 2005b), the addenda document to *STL* dealing with programs, recommends the formation of a Technology Program Committee and, as appropriate, a Technology Program Advisory Committee at the K–12 Technology Program level. In addition to participating in the planning and implementation process, these committees would also serve to direct and advise the evaluation and revision process of the program. Evaluation of curricula is a vital component of overall program evaluation: "**Program evaluation must encompass the evaluation of all components of the program, including content, professional development, curricula, instruction, student assessment, and the learning environment, across grade levels**" (ITEA, 2005b).

The curriculum is one component of many in the overall program evaluation. Some other components are student assessment data; professional development data (in-service or pre-service); data derived from the content of the curriculum, which should be taken from *STL*; learning environment data; instructional data;

and other data (see Figure 19). Please note that in Figure 19, all of the "slices" of the program evaluation "pie" may not be of equal size or value.

The curriculum is one component of educational evaluation.



Note: The slices of the program evaluation "pie" will vary in size.

Curriculum evaluation attempts to answer questions such as:

- *Is the curriculum standards-based?*
- *Did the curriculum result in student achievement of the desired content standards?*
- *Did the curriculum provide for effective student assessment?*
- *Were the identified resource materials appropriate?*
- *Were the instructional strategies effective?*
- *Were the safety and conduct rules appropriate?*
- *Were the laboratory-classroom facilities effective?*

Evaluation is the process of determining the significance or worth of an educational program.

Student assessment is a systematic, multi-step process of collecting evidence on student learning, understanding, and abilities and using that information to inform instruction and provide feedback to the learner, thereby enhancing learning.

Evaluation principles are the basic truths, laws, or assumptions held in the use of evaluation.

Evaluation Versus Assessment

For the purpose of clarification in the addenda series, the writers have taken the position that programs are evaluated and people are assessed. Both evaluation and assessment play significant roles in curricula. Curriculum evaluation is the process by which data are collected to determine how well the curriculum is helping students become more technologically literate. Teachers and other curriculum developers use the evidence collected by evaluation to make revisions to curricula. Assessment, on the other hand, refers to the systematic, multi-step process of collecting evidence of learning, understanding, and abilities and using that information to inform instruction and provide feedback to the learner.

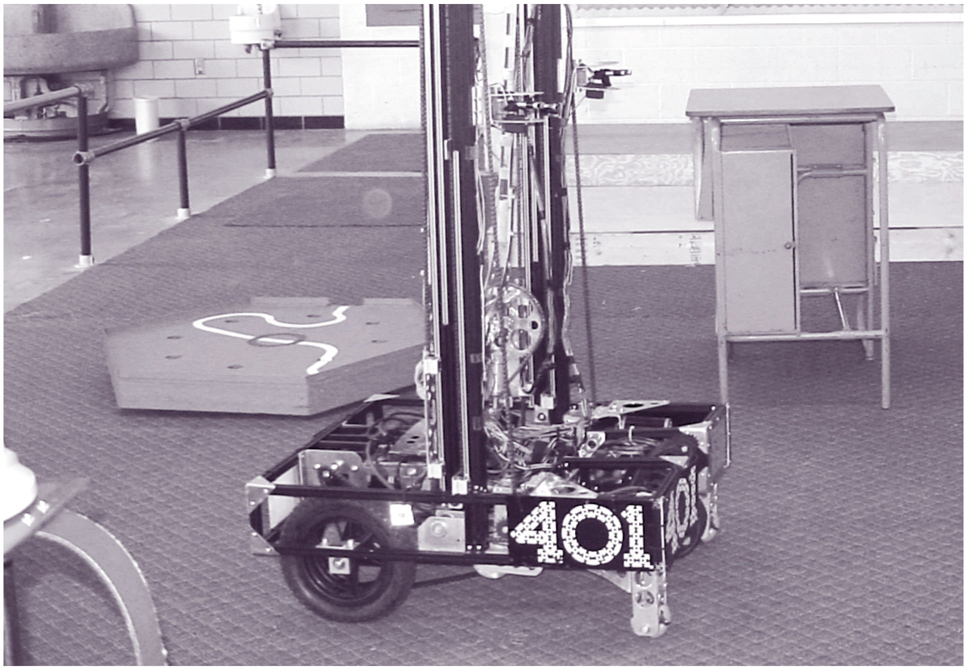
Principles of Evaluation

As teachers and other curriculum developers approach technology curriculum evaluation, there are a number of principles that need to be considered. The principles that follow are not meant to provide an all-inclusive listing. Instead, these principles provide initial direction to users as they approach evaluation. Users will likely consider principles of evaluation that are not listed below. Some principles of effective evaluation of curricula include:

- Occurs systematically and continuously.
- Addresses an identified purpose.
- Is based on standards.
- Is research-based and objective.
- Establishes valid and reliable measurements.
- Utilizes fair and equitable methods.
- Incorporates both formative and summative measures.
- Draws data from multiple sources.

Occurs Systematically and Continuously. Users of *Planning Learning* are aware of the need to employ systematic, continuous evaluation. They establish a system for collecting and analyzing data. Data take many forms, and the evaluation system accounts for this. Mechanisms are in place in technology classrooms and other subject area classrooms (as appropriate) to routinely collect, analyze, and report evaluation data.

Addresses an Identified Purpose. Before evaluation can begin, it is necessary to answer the question: *Why evaluate the curriculum?* Evaluation should be purposeful. We must clarify upfront the purposes of evaluation to be able to determine the type of evidence needed to make judgments about the quality of the curriculum. The purpose



defines why users are evaluating the curriculum. A helpful way to identify the evaluation purpose is by specifying questions about the curriculum that need to be answered. *Is the curriculum aligned with the standards in* STL *and* AETL*? Are students achieving the standards in* STL *and* AETL*?*

Is Based on Standards. It is imperative that evaluation be consistent with the standards and guidelines of *STL* and *AETL* as well as state/provincial/regional, and school district standards. Users of *Planning Learning* also consider other academic standards.

Is Research-Based and Objective. Evaluation measures are established to reflect current research on evaluation. Evaluation methods are frequently reviewed and revised to keep practices current and up-to-date. Tools and instruments are used that gather data to objectively judge the quality of the curriculum. Opinions and feelings are not considered as the primary source for evaluation data.

Establishes Valid and Reliable Measurements. Evaluation provides measurable evidence to judge the effectiveness of the curriculum. In order to judge the quality of the curriculum, teachers and other curriculum developers must have valid data to use when making decisions. "Validity focuses on the accuracy or truth of the information (data) collected in the [evaluation] process, while reliability attempts to answer concerns about the consistency of the information (data

***Valid* means having or containing premises from which the conclusion may logically be derived, correctly inferred, or deduced.**

SECTION 4

Reliable means capable of being relied upon; dependable; and may be repeated with consistent results.

collected)" (ITEA, 2003, p. 23). Reliability describes the consistency with which an evaluation measures what it intends to measure. Evaluation methods gather evidence specific to the purposes for which they are designed. The purposes of evaluation remain consistent throughout data collection, analyzing, and reporting.

Utilizes Fair and Equitable Methods. The tools and methods used to evaluate the curriculum should be free of bias. "[Evaluation] bias refers to qualities of an [evaluation] instrument that offend or unfairly penalize a group of examinees because of examinees' gender, ethnicity, socioeconomic status, religion, or other such group-defining characteristics" (Popham, 1999, p. 67). The evaluation methods must be fair and equitable.

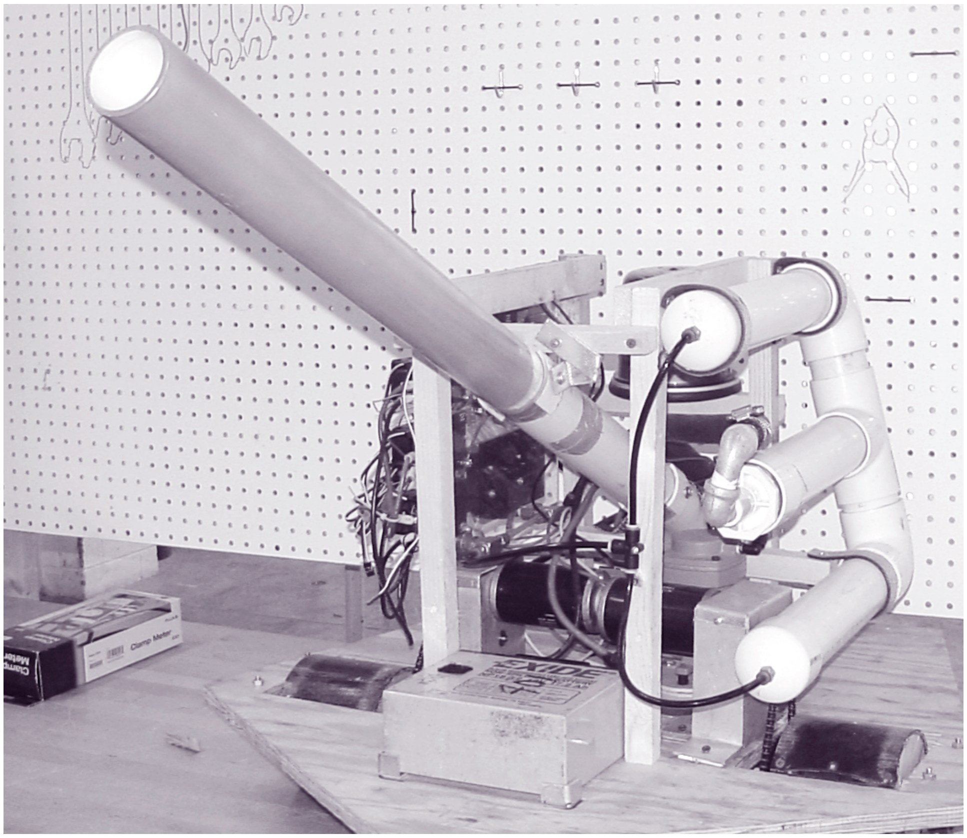
Evaluation is generally characterized as being formative or summative.

Incorporates Both Formative and Summative Measures. Evaluation is generally characterized as being formative or summative. Evaluation is a continuous process. The ongoing evaluation that occurs throughout curricular implementation is referred to as formative evaluation. Formative evaluation enables those delivering the curriculum to adjust teaching as it occurs to enhance student learning. Evaluation data that are collected at prescribed intervals are called summative evaluation. Summative evaluation is cumulative. It indicates whether or not student technological literacy has been improved. Both formative and summative evaluation are critical to a well-rounded evaluation approach (ITEA, 2004).

As teachers carry out the plan for learning, they make numerous efforts to monitor student thinking and understanding, judging whether content standards are being achieved. A teacher implementing a curriculum for the first time may refer to this process as *pilot testing,* and it allows the teacher to make changes to the curriculum on a day-by-day basis, if necessary, to help students achieve the learning goals. This is not to be confused with evaluation of instruction, although the two are linked. Both instruction and the curriculum are evaluated by the teacher on an ongoing basis. A curriculum developer who is not a teacher may conduct a more formalized pilot test across a relatively small sample of classrooms and use the information on effectiveness to adjust the whole curriculum before introducing it to a larger sample. In other words, pilot testing "tries out" the curriculum to see how effective it is. Following the pilot test and resulting revisions, curriculum developers may also wish to try out the curriculum on a larger sample of classrooms, potentially in several schools, school districts, or states. This is referred to as *field* *testing*. The results of the field test can be valuable in revising and improving the curriculum prior to districtwide, statewide, or nationwide dissemination. In his book titled *Developing Inquiry-Based Science Nationwide*, Herbert Their states that formative evaluation ". . . includes evaluation activities that take place as the [curricular] materials are being developed and field tested" (Their, 2001, p. 133).

Summative evaluation is typically administered at a culminating point in the curriculum. For a teacher this might be at the end of a lesson, unit, or course. Inputs to summative evaluation may include such things as student assessment results, other forms of formative evaluation results, and survey data. Summative evaluation is used by teachers to judge the effectiveness of the "whole" curriculum—whether at a course, unit, or lesson level. It provides teachers with an overall perspective on the effectiveness of the curriculum. Other curriculum developers will likely use the results of a large dissemination effort to gather summative data on the effectiveness of the curriculum.

Both formative and summative evaluation provide data that can be used to monitor curriculum effectiveness. Each one has its advantages as well as its constraints. By collecting evidence during and following



curriculum implementation, teachers and other curriculum developers can get a better picture of the effectiveness of a given curriculum and its components.

Draws Data from Multiple Sources. Multiple sources of information provide the data for effective evaluation. Evaluation of the curriculum should consider not only a variety of data gathering methods and instruments, but the population from whom data is gathered. Some potential populations may include students, teachers, supervisors, and parents, for example.

Approaching Curriculum Evaluation

Appendix K is a very general checklist for evaluating standards-based curricula, courses, units, or lessons. Users are cautioned that it is not intended to substitute for a formal evaluation; rather it is intended to provide a sort of "birds-eye view" of the status of curricula. *Planning Learning* suggests that teachers and other curriculum developers approach curriculum evaluation by:

- Planning for Curriculum Evaluation.
- Collecting and Analyzing Evidence.
- Gathering and Analyzing Additional Data.
- Reporting Findings.
- Revising and Rejuvenating Technology Curriculum.

Plan for Curriculum Evaluation. A systematic and continuous plan for technology curriculum evaluation should be developed. Teachers and other curriculum developers, perhaps working with the Technology Program Committee and/or the Technology Program Advisory Committee, plan evaluation so data are collected for a specified period of time. The evaluation plan describes what constitutes a well-designed and implemented curriculum. Curriculum evaluation is purposeful. That is, the purpose of curriculum evaluation as well as the identified audience are clearly stated within the evaluation plan. Data are collected to address a specific concern or answer a stated question. The evaluation plan takes into account the purpose of the curriculum and is designed to collect data that determine whether or not the curriculum is achieving its intended purpose. Care should be taken to consider any legal, political, and policy constraints that may result from the evaluation. The parameters of the evaluation should be decided in the plan. This plan utilizes *STL* as the basis for curriculum content. *AETL* is used to establish criteria for student assessment, professional development, and program enhancement. Decisions are made about what units of measure are appropriate and how the results will be reported. It is important to determine what the technology program will be held accountable for in this evaluation. Additionally, the plan for evaluation addresses how validity and reliability are to be taken into account in the evaluation process.

Collect and Analyze Evidence. The process of collecting and analyzing evidence for a quality technology curriculum is very important. The data collected by evaluation become the ingredients for curricular decision making. Data collecting methods and instruments need to be developed. This can be an overwhelming process, and *Planning Learning* suggests that teachers work in collaborative teams where possible. The process of data collection is established on both a formative and a summative basis. Evaluation data is collected from a number of sources. Many of the data collected in the formative evaluation become valuable ingredients in the summative evaluation. This is especially true in utilizing effective student assessment as an ingredient or input for the summative evaluation. Data collection must comply with accrediting agencies as well as state and federal mandates. The school accrediting agencies may be regional accrediting agencies, such as the Southern Association for the Accreditation of Schools and Colleges, or they may be state agencies which accredit schools within their state. Very detailed guidelines for this accrediting process are given to the school administration as well as all teachers involved. A detailed self-study is conducted by the various subject area departments and other administration areas within the school. After this is accomplished, a visiting team of educators assess the overall program and various curricular areas in the school. Some potential sources from which evaluation data may be drawn include:

- Pilot Test Results
- Field Test Results
- Student Surveys
- Student Interviews
- Student Assessment Results (Formative and Summative)

Gather and Analyze Additional Data. Evaluators will need to determine if any information is "missing." In other words, will the evaluators be able to answer all of their questions about the curriculum? Evaluators may wish to use data from the larger aspect of the K–12 technology program within which the curriculum exists (or perhaps the K–5, 6–8, or 9–12 technology program, if curricula is being evaluated at a smaller

scale). After all of the data has been gathered and analyzed, evaluators must review the data in relation to the questions they have posed about the curriculum. A decision about the effectiveness of the curriculum will need to be made based on all available data.

Report Findings. After the formative and summative data have been collected and analyzed, they are organized into a coherent format, such as a formal report, so the findings can be made available. Both successes and failures should be included, as well as recommendations for correcting any problems or deficiencies. It is important to identify courses within a school or school district where curricula are being well implemented based upon evaluation results. These can serve as models for curricula that are not considered exemplary. The person (or group) given this responsibility must be able to analyze and synthesize the technology curriculum data in a way that can be understood by the intended audience. A good rule to follow is to present the information as though it were going to be read by someone who is not an educational professional. The person or group should remain mindful of the purpose of the evaluation. And finally, the report must be disseminated to the intended audience.

At the minimum, evaluators should report findings to the Technology Program Committee responsible for the K–12 technology program (or perhaps the K–5, 6–8, or 9–12 technology program, if the curriculum is being evaluated at a smaller scale). Listed below are some recommendations for reporting the curriculum evaluation findings:

1. An evaluation report containing data, notations of discrepancies, and recommendations is made annually.
2. Findings from the curriculum evaluation are disseminated to the appropriate decision makers for the technology program.
3. Discrepancies between the curriculum status and standards (*STL* and *AETL*) are reported to the appropriate decision makers.
4. Recommendations for correcting deficiencies are reported to appropriate decision makers.

Typical reports could include the following elements:

- Title
- Purpose of the program evaluation
- Background information
- Who conducted the program evaluation
- Timetable for program evaluation
- Specific topics covered in the program evaluation
- Populations who provided information on the evaluation
- Analysis of results
- Summary of results

Revise and Rejuvenate Technology Curricula. Decisions for improving a curriculum are based on the evaluation report, including how well the curriculum addresses *STL*, and local need and resources, such as staff, time, funding, and professional development needs. A written course of action for each deficiency is prepared by those evaluating the curriculum. Decisions could involve revising existing units and lessons or adopting alternative units and lessons. It is conceivable that a curriculum may be determined to be at the incorrect grade level, and it may be moved up or down within the program structure. It is possible that the findings will show that part of the curriculum does not address the needs of all students and needs to be more equitable and appealing. To some degree, these and similar determinations will be value judgments made by teachers and others based upon their professional experience. Those responsible for the technology program need to determine priorities and actions for correcting any deficiency in the curriculum. A mechanism needs to be built into this evaluation process that assures that the actions taken have successfully corrected the deficiency.

Once program evaluation (including evaluation of curricula) has been completed and the curriculum has been revised, it must be implemented (or re-implemented) in the laboratory-classroom. It is important to continue to collect both formative and summative evaluation data. Curriculum changes should be monitored through a formative evaluation plan to determine the effect of those changes on other program components, such as other courses at other grade levels and articulation arrangements between schools. The revisions will hopefully rejuvenate the program, resulting in better teaching and learning. This process of curriculum evaluation must be ongoing and it should be repeated on a regular basis, and minor revisions should be made as needed. *Planning Learning* recommends a 3–5 year curriculum evaluation cycle. Again, this process should comply with *STL* and *AETL* as well as accrediting agencies and state and federal mandates.

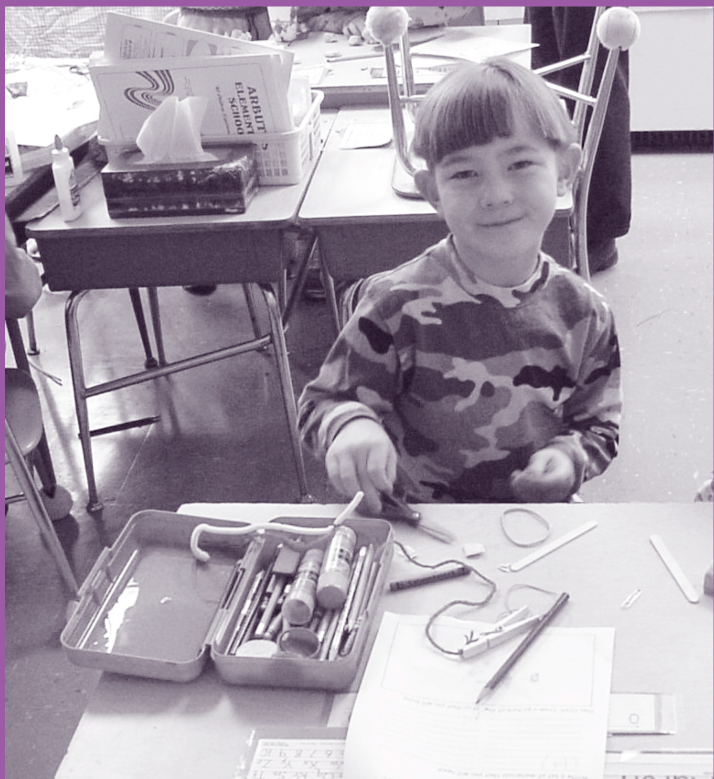
Enhancing Technological Literacy

The overall purpose of technology curriculum evaluation is to improve the technological literacy of all students.

The overall purpose of any curriculum evaluation effort is to improve the technological literacy of all students. It is generally accepted by most educators that the use of standards-based curriculum evaluation should result in the enhancement of education in general. This enhancement will positively impact the overall school and community.

Curriculum is an essential component of the technology program. Evaluating curriculum gives those responsible for the program a means for providing "checks and balances" in the quality of the program. By developing quality curriculum and evaluation, technological literacy will be greatly enhanced. This means that the structure and the plan of the curriculum will be targeted more closely to what students should know and be able to do in technology. As a result, students will be able to use, manage, evaluate, and understand technology more effectively.

SECTION 5
Making a Difference



This section provides direction for teachers and other curriculum developers in considering the relationship between curricula and systemic reform.

Planning Learning is intended to provide guidance to teachers and other curriculum developers in developing contemporary curricula that promote technological literacy for all students. It is based comprehensively on *Standards for Technological Literacy: Content for the Study of Technology* (*STL*) (ITEA, 2000/2002) and *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* (*AETL*) (ITEA, 2003). Systemic reform in the study of technology depends on curriculum adoption efforts; education for teachers and other curriculum developers; state/provincial/regional leadership; and support and advocacy for technological literacy.

Curriculum Adoption

For successful implementation, the curriculum needs to be understood and approved by local school boards, principals, guidance counselors, school faculty, technology teachers, students, and parents. These stakeholders need to know the role of the study of technology in the total school program and its many benefits for students. Local programs need to emphasize the role of the study of technology in a child's educational development and in educational reforms across the school curriculum. Articulated K–12 technology programs are needed; technological literacy development begins with students' engaged learning experiences in elementary grades, continues in middle school explorations, and culminates in wide-ranging applications in the high school. Teachers need to implement quality curricula that are standards-based and tailored to the educational needs, abilities, and interests of their students. Successful local adoption depends on:

- Proving the value of the study of technology.
- Setting high program and student expectations.
- Providing quality classroom experiences.
- Promoting student achievement.
- Engaging in continuous program and curriculum improvements.

Local curriculum adoption requires a vested interest on the part of teachers, administrators, and other stakeholders in maintaining high program and student expectations.

Teacher Story

Matching Curricula to Program Goals and the Local Community: Share the Wealth

Steve Meyer

As a new teacher in a district, with the job of taking a traditional/vocational program and rebuilding it to meet the current needs of educating our youth about technology, *Standards for Technological Literacy: Content for the Study of Technology (STL)*, and *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards (AETL)*, along with other supporting documents, have proven to be invaluable resources. These references have played a crucial part in not only saving the technology education program, but also validating the development of a broad-based program intended for all students in our school system. It is this last idea, "technological literacy for all," that I would like to expand upon.

With the goal of rebuilding a program to meet current practices in technology education, there were three issues/problems that needed to be addressed first:

- Updating the curricular content to meet the standards in *STL*.
- Increasing enrollment in the program.
- Increasing the diversity of the students participating in technology education.

With these three issues/problems in mind, I set out on a journey. That journey followed the main theme "technological literacy for all" that recurs over and over throughout *STL* and *AETL*. Breaking that theme down always validated the three issues I set out to solve. First off, "technological literacy" meant that the traditional/vocational skills that had been taught for years needed to be updated to include current technological content. Secondly, "for all" reinforced the notion that more students from a more diverse population needed to be involved in the program.

One of the classes I am currently teaching is called Manufacturing Systems. One of the reasons I proposed and am developing this class is that our school is located in the industrial rich Fox Valley area of Brillion, Wisconsin. There are three multi-million dollar, manufacturing-related companies within one mile of the school including Ariens Company, Endries International, and Brillion Ironworks. All three companies are very progressive and very supportive of teaching all students broad-based technology skills and concepts. I shared the standards and accompanying documents with the supervisors of these companies. They were very happy that the skills and knowledge stressed in the standards were in place in our school.

Another reason for developing and teaching this class is that it is a great content area for engaging students with a wide variety of interests in many different areas such as design, business, human relations, and marketing, along with the different manufacturing-related careers. Many of the benchmarks, which drive my choice of curricular content in this area, come from The Designed World Standard 19, "Students will develop an understanding of and be able to select and use manufacturing technologies" (ITEA, 2000/2002, p. 182). The class structure is very similar to a more traditional production class; however, we incorporate many "breakout lessons" on product development, tooling design, material management, automation, program logic control, packaging, etc. Students then incorporate these breakout lessons into their final production project.

In order to increase the publicity of this class to attract a wider variety of students, I added a twist. We design a product and the system to produce it for others to work with, rather than just designing a production system for only our class to use. My students then train other students to work with the different manufacturing cells. Designing a manufacturing system for others to use is very realistic and creates issues and problems that require students involved to think like technologists. They must use, manage, evaluate, and understand technology. Specific issues that students must think about include people management, safety, efficiency, etc. Here students are truly able to assess their technological development. So far we have developed production systems for kindergarten students and those with special needs. Not only does the class structure cover technological issues, but it also encompasses the important idea of character education.

The class has proven to attract a wide variety of students. I now have students of all ages, interests, ethnicities, and genders involved in Technology Education. *STL* and *AETL* have given me guidelines to follow, yet they still allow me to develop my own style of curriculum to teach technological content.

"The promise of the future lies not in technology alone, but in people's ability to use, manage, assess, and understand it" (ITEA, 1996; 2003). This statement is truly the key to rebuilding and sustaining a dynamic, all-encompassing Technology Education Program. *STL*, *AETL*, and accompanying documents and resources are the catalysts for sharing the wealth and joy of technology education with everyone now and in the years to come.

Steve Meyer is a technology education instructor at Brillion High School in Brillion, Wisconsin. He can be reached at smeyer@brillion.k12.wi.us.

Education for Teachers and Other Curriculum Developers

Developing quality technology curricula requires continuous professional education to fully implement *STL*. Teachers must be adequately prepared at the pre-service level and receive continuous in-service training. All users of this guide should be knowledgeable about *AETL*, particularly the professional development standards in *AETL*, and understand the nature and role of *STL*. Education helps keep teachers and other curriculum developers current in research on teaching and learning, contemporary delivery strategies, effective teaching approaches, and student assessment. Also, teachers need to interact with their peers concerning curriculum considerations, program transitions, and long-term improvements. Professional development plays a critical role in successful curriculum implementation. Teachers and other curriculum developers can support staff development initiatives by:

- Conveying professional development needs to principals, supervisors, and teacher educators.
- Remaining knowledgeable about *AETL*, especially the professional development standards.
- Developing an action plan for professional development.
- Attending local, state/provincial/regional, and national/federal conferences.
- Keeping current with technology content and pedagogy.
- Engaging in continuous professional improvement.

SECTION 5

Teachers benefit from well-designed teacher workshops and networking opportunities. Professional development is needed along a continuum of teacher experience and expertise. Master teachers can be identified and trained to model effective teaching behaviors and to coach other teachers. Beginning teachers can be mentored and supported through teacher networks.

Teacher educators and their programs have a responsibility and commitment to prepare effective teachers; to provide experiences that reflect contemporary research on teaching and learning, technology education foundations, content, and practices; and provide guidance to new and experienced teachers. Teacher preparation programs can provide leadership for:

- Collaborating with state departments and local districts to provide teacher training.
- Developing effective curriculum resources.
- Creating outstanding teachers.
- Promoting the study of technology to state and local stakeholders.
- Sponsoring teacher in-service workshops and student competitions.
- Preparing teachers to effectively implement contemporary curriculum.

Teachers and other curriculum developers can involve teacher educators in developing and implementing state/provincial/regional curriculum frameworks. Further, teacher educators can provide input to local adoption and conduct professional development activities. Preparation and enhancement of teachers and other curriculum developers is an important link to systemic reform for the study of technology.

State/Provincial/Regional Leadership

The state/provincial/regional curriculum framework reflects the vision for the study of technology, its program goals, and student expectations. Leadership is necessary to develop a clear vision and framework based on contemporary technological content (*STL*) and practices (*AETL*). Teachers and other curriculum developers can develop support from state/provincial/regional leadership by:

- Focusing on technology programs that are articulated from Grades K–12.
- Developing a curriculum within the program structure.
- Disseminating and interpreting the curriculum.
- Supporting local curriculum development and adoption.
- Collecting data on student achievement and program effectiveness.

Support and Advocacy for Technological Literacy

Successful curriculum implementation involves support systems that stimulate innovation and risk-taking at the local level. Advocates at all educational levels are needed to provide guidance and support to teachers implementing new or revised curriculum. Teachers and other curriculum developers can develop support and advocacy by:

- Meeting regularly with a technology program advisory committee.
- Working with teachers in other disciplines to integrate content across subject areas.
- Establishing education-business-community linkages.
- Promoting technology programs to parents and the community.
- Gathering data about student achievements and program successes.
- Networking with teachers in other schools, school districts, and states/provinces/regions.

Advocates such as parents, business leaders, community representatives, political leaders, and school administration can help teachers deliver effective technological study experiences for students. Obstacles such as funding, facilities, scheduling, resources, and personnel become opportunities when excellent support is obtained through advocacy.

Obstacles such as funding, facilities, scheduling, resources, and personnel become opportunities when excellent support is obtained through advocacy.

Teacher Story

Adjusting Curriculum to a Revised Student Population
Teachers Working Together
Howard Stob

Our school district was facing a 14 million dollar deficit, we were losing 500+ students a year to charter schools, and the state was trying to balance a multi-billion dollar loss in revenue. Our district decided to close 14 elementary buildings, cut personnel, eliminate "nonessential" programs, and cut bussing for middle and high school students.

Restructuring the Technology Program

Our building was closed. Our program moved across town to another building. We would become a new program that integrated mathematics, science, and technology. Our student population came from a different district quadrant. We lost more than half of our previous student population. We added five "new" teachers to our program. And we weren't able to get into our building until two weeks before the students arrived.

As teachers, we planned during the summer. We tried not to reinvent the wheel. We wanted to incorporate research-based concepts to graduate students who will be able to adapt, gather and interpret information, become a technologically literate person, and be a valuable member of our community. We started using The Four-Blocks Literacy Model® to focus the teaching of reading, EveryDay Math® to teach the concepts of mathematics, and Foss® and Battle Creek® kits to help teach science. With *No Child Left Behind* mandated by the government, the school year started off with a lot of confusion. How could we teach everything during the limited time we have during the school day?

Through the guidelines and standards of Grand Rapids Public Schools and the State of Michigan, we looked at how reading, math, and science standards would fit into a technology education model based on ITEA's *Standards for Technological Literacy* (*STL*). The main idea was that learning without application would not lead to the successes our students needed.

Restructuring the Curriculum

Because of our involvement with ITEA, its development of technology content standards, and participation in the CATTS consortium, we knew that a solid technology education curriculum would be the vehicle that would coordinate and deliver our subject material.

Some terminology we used to help develop our curriculum:

1. Science: Science is the pursuit of new knowledge about nature. Its primary goal is knowledge, not solutions to problems. (Technology in the form of inventions usually comes before science. For example, compasses were invented hundreds of years before science understood [discovered] how they worked.)
2. Design: In the broadest sense, it is the process of designing solutions to technological problems and different ways to solve them, including: troubleshooting, research and development, invention and innovation, experimentation. It is the core problem-solving process of technological development. Design is one type of problem solving.
3. Mathematics: Using Everyday Mathematics®, content is focused in six strands: Operations & Computation, Numeration, Patterns & Functions & Algebra, Data & Chance, Measurement & Reference Frames, and Geometry.
4. Reading: Using the Houghton Mifflin Reading Series®, we coupled it with The Four-Blocks Literacy Model® to teach guided reading, self-selected reading, writing, and working with words. Every student was given the Gates MacGintie® reading test at the beginning of school with a post test at the end.
5. Social Studies: Based on Lansing, Michigan School district's curriculum, every grade studies: Civics, Geography, History, Economics, Current Events, and Core Democratic Values.

The Current State of the Technology Program and Curriculum

The fun part of teaching in our school is seeing the excitement of the students as they move from area to area without thinking that each lab is directly tied in with the other. Once a week, each child participates in a special lab:

1. Math Lab: Here students participate in a manipulative environment where concepts previously introduced are taught in a different way or method.
2. Science Lab: Using Foss® and Battle Creek® kits, students discover science concepts through hands-on activities.
3. Design/Technology Lab: Using science/math/reading objectives, ITEA's *STL*, and ITEA CATTS materials, students learn to research, compare/contrast, build models, and evaluate solutions to problems.

4. Computer Lab: We have 2 Apple MacIntosh IBook® mobile carts (30 laptops and a printer). Along with basic keyboarding, students learn to use the computer as a tool to present things learned in the other three labs. Students are taught to use a database, a spreadsheet, word processing (AppleWorks®), Safari/Explorer® Internet, PowerPoint®, HyperStudio®, KidPix®, Inspiration®, digital/video cameras, and an Epson® scanner.

The United States is now in the technology information age. Our students need to be prepared to use, manage, evaluate, and understand the volumes of information that they encounter each day.

How will we know if we are successful? Parents are one of the most valuable components we have. Presently, 46 adults are volunteering one hour a week to mentor students in reading. Keeping track (recording) data using FileMaker Pro® and monthly interpretation of this data will hopefully give us the ability to change what doesn't work and improve what does. As the old adage says: "time will tell..."

Howard Stob is a Tech Specialist at Shawnee Math Science Tech Academy (Pre-K–6) in Grand Rapids, Michigan. He can be reached at hstob@mac.com.

Call to Action

A standards-based, contemporary curriculum for the study of technology is based on a clear vision, commitment to teaching and learning excellence, and quality educational experiences for all students. *Planning Learning* provides direction and suggestions for changes in the study of technology. It is a springboard from which localities and states/provinces/regions can develop a comprehensive and articulated K–12 curriculum for the study of technology. Systemic reform for the study of technology can be achieved when teachers and other curriculum developers work in conjunction with the larger educational system to develop and implement curriculum that helps all students attain technological literacy.

The very nature of organizations argues that we succeed when all parties are rowing in the same direction. We will realize the promise of school reform when we establish standards and expectations for reaching them that are clear, not confusing; essential, not exhaustive. The result will be a new coherence and a shared focus that could be the most propitious step we can take towards educating all students well (Marzano & Schmoker, 2005).

Systemic reform for the study of technology can be achieved when teachers and other curriculum developers work in conjunction with the larger educational system to develop and implement curriculum that helps all students attain technological literacy.

Teacher Story

Community, Advocacy and Program Revision

Terry Crissey

The decade 1990 through 2000 was a tumultuous one for education in Pennsylvania. Things were changing, there was no clear consensus regarding issues like standards or assessment. To instigate an energetic discussion, bring up the concept of technology education with a circle of industrial arts teachers.

Forest Hills is a rural school district located northeast of Johnstown, Pennsylvania, with an enrollment of 2,308, including 660 high school and 618 middle school students. The area has been subjected to rapid changes in the job market, technological advances, global competition, and shifts in the demand for goods and services. As development in hi-tech manufacturing rekindled demand for skilled workers, career education returned to schools previously preparing students exclusively for college. To meet the challenges of the market place, students needed to have access to comprehensive, up-to-date secondary and post-secondary education. Future employment would require multi-facetted technical skills: lacking these skills would ensure difficulty gaining and maintaining meaningful employment. Forest Hills began to prepare for these changes.

As Forest Hills began the development of its technology education program, high school principal, Don Bailey and the middle school principal, Ray Wotkowski, made a commitment to the future. With the support of the Board of Directors and the administrators, curriculum was developed, written, and fielded. Early on in the process, a need for a post-secondary alliance was identified. Joe Pecosh, Joe Sanfillipo, Glen Hider, and Stan Komacek from California University of Pennsylvania, enabled this link joining our technology advisory board. The players were in place and the process could begin.

With the guidance received and the questions asked at advisory board meetings, the program developed. The board, by charter, meets annually with additional meetings scheduled as needed. Recognizing that public support was a necessary component, newsletters, open houses, and surveys were successfully employed and achieved the desired results. Students were involved; they learned what technology education could do for them. Two constants, a living scope and sequence and the advisory board, have proven to be the anchors staying the course. Students progressively navigate one of the two areas of concentration, Pre-Engineering or Design, guided by a scope and sequence with required and recommended courses.

The achievement of our students has given credibility to a dynamic program that will continue to develop, meeting the needs of the community and the students.

Terry Crissey is a technology teacher at Forest Hills High School in Sidman, Pennsylvania. He can be reached at fhtech@adelphia.net.

APPENDICES

APPENDIX A

Acknowledgements

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Pages 14–16. *Moving from Standards-Reflected to Standards-Based Curricula In a Transnational Classroom*. Adapted from a vignette written by Thomas Loveland, St. Petersburg College, St. Petersburg, Florida.

Pages 57–58. *Matching Curricula to Program Goals and the Local Community: Share the Wealth*. Adapted from a vignette written by Steve Meyer, Brillion High School, Brillion, Wisconsin.

Pages 62–64. *Adjusting Curricula to a Revised Student Population: Teachers Working Together*. Adapted from a vignette written by Howard Stob, Shawnee Math Science Tech Academy, Grand Rapids, Michigan.

Pages 66–67. *Community, Advocacy, and Program Revision*. Written by Terry Crissey, Forest Hills High School, Sidman, Pennsylvania.

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APPENDIX B

Listing of *STL* Content Standards

From International Technology Education Association. (2000/2002). *Standards for technological literacy: Content for the study of technology*. Reston, VA: Author.

Note: These standards are provided for reference only. All standards should be met through the benchmarks that follow each standard in* Standards for Technological Literacy, *which is available online at www.iteawww.org.

The Nature of Technology

Standard 1. Students will develop an understanding of the characteristics and scope of technology.

Standard 2. Students will develop an understanding of the core concepts of technology.

Standard 3. Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

Technology and Society

Standard 4. Students will develop an understanding of the cultural, social, economic, and political effects of technology.

Standard 5. Students will develop an understanding of the effects of technology on the environment.

Standard 6. Students will develop an understanding of the role of society in the development and use of technology.

Standard 7. Students will develop an understanding of the influence of technology on history.

Design

Standard 8. Students will develop an understanding of the attributes of design.

Standard 9. Students will develop an understanding of engineering design.

Standard 10. Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

Abilities for a Technological World

Standard 11. Students will develop the abilities to apply the design process.

Standard 12. Students will develop the abilities to use and maintain technological products and systems.

Standard 13. Students will develop the abilities to assess the impact of products and systems.

The Designed World

Standard 14. Students will develop an understanding of and be able to select and use medical technologies.

Standard 15. Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.

Standard 16. Students will develop an understanding of and be able to select and use energy and power technologies.

Standard 17. Students will develop an understanding of and be able to select and use information and communication technologies.

Standard 18. Students will develop an understanding of and be able to select and use transportation technologies.

Standard 19. Students will develop an understanding of and be able to select and use manufacturing technologies.

Standard 20. Students will develop an understanding of and be able to select and use construction technologies.

APPENDIX C
Listing of *AETL* Student Assessment Standards

Taken from International Technology Education Association. (2003). *Advancing excellence in technological literacy: Student assessment, professional development, and program standards.* Reston, VA: Author.

Note: These standards are provided for reference only. All standards should be met through the guidelines that follow each standard in **Advancing Excellence in Technological Literacy,** ***which is available online at www.iteawww.org.***

Standard A-1: Assessment of student learning will be consistent with *Standards for Technological Literacy: Content for the Study of Technology (STL)*.

Standard A-2: Assessment of student learning will be explicitly matched to the intended purpose.

Standard A-3: Assessment of student learning will be systematic and derived from research-based assessment principles.

Standard A-4: Assessment of student learning will reflect practical contexts consistent with the nature of technology.

Standard A-5: Assessment of student learning will incorporate data collection for accountability, professional development, and program enhancement.

APPENDIX D
Listing of *AETL* Professional Development Standards

Taken from International Technology Education Association. (2003). *Advancing excellence in technological literacy: Student assessment, professional development, and program standards*. Reston, VA: Author.

Note: These standards are provided for reference only. All standards should be met through the guidelines that follow each standard in* Advancing Excellence in Technological Literacy, *which is available online at www.iteawww.org.

Standard PD-1: Professional development will provide teachers with knowledge, abilities, and understanding consistent with *Standards for Technological Literacy: Content for the Study of Technology* (*STL*).

Standard PD-2: Professional development will provide teachers with educational perspectives on students as learners of technology.

Standard PD-3: Professional development will prepare teachers to design and evaluate technology curricula and programs.

Standard PD-4: Professional development will prepare teachers to use instructional strategies that enhance technology teaching, student learning, and student assessment.

Standard PD-5: Professional development will prepare teachers to design and manage learning environments that promote technological literacy.

Standard PD-6: Professional development will prepare teachers to be responsible for their own continued professional growth.

Standard PD-7: Professional development providers will plan, implement, and evaluate the pre-service and in-service education of teachers.

APPENDIX E
Listing of *AETL* Program Standards

From International Technology Education Association. (2003). *Advancing excellence in technological literacy: student assessment, professional development, and program standards.* Reston, VA: Author.

Note: These standards are provided for reference only. All standards should be met through the guidelines that follow each standard in* Advancing Excellence in Technological Literacy*, which is available online at www.iteawww.org.

Standard P-1: Technology program development will be consistent with *Standards for Technological Literacy: Content for the Study of Technology (STL).*

Standard P-2: Technology program implementation will facilitate technological literacy for all students.

Standard P-3: Technology program evaluation will ensure and facilitate technological literacy for all students.

Standard P-4: Technology program learning environments will facilitate technological literacy for all students.

Standard P-5: Technology program management will be provided by designated personnel at the school, school district, and state/provincial/regional levels.

The Current State of The Curriculum: *Where Are We Now?*

Directions: Circle Yes, No, or N/A.

Considerations for Standards-Based Technology Curriculum Planning	Yes	No	Not Applicable (N/A)	Comments
Is the technology curriculum based on *Standards for Technological Literacy: Content for the Study of Technology*? • Nature of Technology • Technology and Society • Design • Abilities for a Technological World • The Designed World	Yes	No	N/A	
Is the technology curriculum based on school district, state/provincial/regional, and national/federal standards in other academic areas?	Yes	No	N/A	
Is the curriculum designed and implemented as to enable all students to attain technological literacy?	Yes	No	N/A	
Is the curriculum planned and developed • Across grade levels? • Across disciplines?	Yes Yes	No No	N/A N/A	
Is both formative and summative student assessment integrated within the curriculum?	Yes	No	N/A	
Does the curriculum incorporate suitable cognitive, psychomotor, and affective learning elements?	Yes	No	N/A	
Does the curriculum accommodate for student commonality and diversity?	Yes	No	N/A	
Does the curriculum take into account fairness and equity issues?	Yes	No	N/A	
Is instruction designed to meet curricular goals and student needs?	Yes	No	N/A	
Is there a plan for curriculum evaluation?	Yes	No	N/A	
Does the curriculum evaluation involve • Formative measures? • Summative measures?	Yes Yes	No No	N/A N/A	
Has the curriculum been pilot tested or field-tested?	Yes	No	N/A	

APPENDIX G
Responsibility Matrix Form

Directions: Page 1 of this form should be used to indicate which standards in *Standards for Technological Literacy* (*STL*) will be addressed at each grade level of the technology program. Fill in this form using "X" to indicate maximum coverage, "√" to indicate moderate coverage, and "O" to indicate minimal coverage.

Responsibility Matrix Form Page 1

***STL* Standards**	***STL* Coverage in the Technology Program**												
	Elementary Classrooms						Technology Laboratory-Classrooms						
	K	1	2	3	4	5	6	7	8	9	10	11	12
***STL* 1.** Students will develop an understanding of the characteristics and scope of technology.													
***STL* 2.** Students will develop an understanding of the core concepts of technology.													
***STL* 3.** Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.													
***STL* 4.** Students will develop an understanding of the cultural, social, economic, and political effects of technology.													
***STL* 5.** Students will develop an understanding of the effects of technology on the environment.													
***STL* 6.** Students will develop an understanding of the role of society in the development and use of technology.													
***STL* 7.** Students will develop an understanding of the influence of technology on history.													
***STL* 8.** Students will develop an understanding of the attributes of design.													
***STL* 9.** Students will develop an understanding of engineering design.													
***STL* 10.** Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.													
***STL* 11.** Students will develop the abilities to apply the design process.													
***STL* 12.** Students will develop the abilities to use and maintain technological products and systems.													
***STL* 13.** Students will develop the abilities to assess the impact of products and systems.													
***STL* 14.** Students will develop an understanding of and be able to select and use medical technologies.													
***STL* 15.** Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.													
***STL* 16.** Students will develop an understanding of and be able to select and use energy and power technologies.													
***STL* 17.** Students will develop an understanding of and be able to select and use information and communication technologies.													
***STL* 18.** Students will develop an understanding of and be able to select and use transportation technologies.													
***STL* 19.** Students will develop an understanding of and be able to select and use manufacturing technologies.													
***STL* 20.** Students will develop an understanding of and be able to select and use construction technologies.													

Directions: Page 2 of this form should be used to indicate which standards from other content areas will be addressed at each grade level of the technology program. Multiple copies of this form may be needed. Fill in this form using “X” to indicate maximum coverage, “√” to indicate moderate coverage, and “O” to indicate minimal coverage.

Responsibility Matrix Form Page 2

Other Content Area Standards	Standards Coverage in the Technology Program												
	Elementary Classrooms						Technology Laboratory-Classrooms						
	K	1	2	3	4	5	6	7	8	9	10	11	12

Directions: Page 3 of this form should be used to indicate which standards in *Standards for Technological Literacy* (*STL*) will be addressed at each grade level in other content area classrooms. Multiple copies of this form may be needed. Fill in this form using “X” to indicate maximum coverage, “√” to indicate moderate coverage, and “O” to indicate minimal coverage.

Responsibility Matrix Form Page 3

***STL* Standards**	***STL* Coverage in Other Content Areas**													
	6	7	8	9	10	11	12	6	7	8	9	10	11	12
***STL* 1.** Students will develop an understanding of the characteristics and scope of technology.														
***STL* 2.** Students will develop an understanding of the core concepts of technology.														
***STL* 3.** Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.														
***STL* 4.** Students will develop an understanding of the cultural, social, economic, and political effects of technology.														
***STL* 5.** Students will develop an understanding of the effects of technology on the environment.														
***STL* 6.** Students will develop an understanding of the role of society in the development and use of technology.														
***STL* 7.** Students will develop an understanding of the influence of technology on history.														
***STL* 8.** Students will develop an understanding of the attributes of design.														
***STL* 9.** Students will develop an understanding of engineering design.														
***STL* 10.** Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.														
***STL* 11.** Students will develop the abilities to apply the design process.														
***STL* 12.** Students will develop the abilities to use and maintain technological products and systems.														
***STL* 13.** Students will develop the abilities to assess the impact of products and systems.														
***STL* 14.** Students will develop an understanding of and be able to select and use medical technologies.														
***STL* 15.** Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.														
***STL* 16.** Students will develop an understanding of and be able to select and use energy and power technologies.														
***STL* 17.** Students will develop an understanding of and be able to select and use information and communication technologies.														
***STL* 18.** Students will develop an understanding of and be able to select and use transportation technologies.														
***STL* 19.** Students will develop an understanding of and be able to select and use manufacturing technologies.														
***STL* 20.** Students will develop an understanding of and be able to select and use construction technologies.														

Course Level Curriculum Development Workbook
Page 1

Team Member Information

Directions: Record team member contact information.

Team Leader: ______________________________

Phone: ______________ Email: ______________

1. ______________________________

Phone: ______________ Email: ______________

2. ______________________________

Phone: ______________ Email: ______________

3. ______________________________

Phone: ______________ Email: ______________

4. ______________________________

Phone: ______________ Email: ______________

5. ______________________________

Phone: ______________ Email: ______________

Course Level Curriculum Development Workbook
Page 2

Course Information

Directions: Fill in the blanks below.

Name of the Course: ________________________________

Grade Level(s): ____________________________________

Purpose of the Course (1-2 sentences)

____

____

____

What is the placement of this course within the overall program (of study) (including level [e.g., introductory] and connections to other courses).

____

____

____

Course Overview (including topics covered and expectations for student involvement)

____

____

____

____

____

Length of the Course: ________________________________

Prerequisites for the Course:

____

____

Course Level Curriculum Development Workbook
Page 3

Course Goals and Objectives

Directions: List the Major Course Goals (maximum 8)

At the completion of this course, students will know and understand:

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________

Directions: List the Major Performance Objectives Associated with this Course (maximum 10)

At the completion of this course, students will be able to:

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________
10. ______________________________

NOTE: Attach a copy of the Responsibility Matrix Form developed for the course. (See Appendix G if you do not have one.)

Course Level Curriculum Development Workbook
Page 4

Course Assessment

Directions: Identify and record the tools and methods that will be used to assess students for this course. The tools and methods you select will depend upon how you structure assessment for the course. For example, you may or may not choose to develop a summative course level assessment instrument. You might choose to incorporate unit level assessment tools and methods, or you might choose to look at unit level assessment results holistically. In any case, the tools and/or methods you choose should incorporate student work over time and include variety in both content and method.

Performance Tasks and Projects (consider scope and sequence):

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________
10. ______________________________

Written Assessments (student self-assessment, concept mappings, quizzes, tests, and any other written assessment planned for the course):

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________

Course Level Curriculum Development Workbook
Page 5

NOTE: You will need a copy of pages 5-8 for each unit that is developed.

UNIT LEVEL—Identify Standards, Then Select Benchmarks

Directions: Identify the standards that will be addressed in the unit. Then select the benchmarks that provide further detail to your unit. It is generally recommended that you address no more than two or three standards in each unit. You may take this opportunity to group the selected standards and benchmarks into multiple units. Please consult the Responsibility Matrix Form for your course. It is necessary to consider national, state/provincial/regional, and school district technological literacy standards as well as standards in other subject areas.

UNIT TITLE: ____

Standard(s): ____

____

____

____

Benchmark(s): ____

____

____

____

UNIT LEVEL—Extract and Organize Content

Directions: Identify the big ideas that students should learn to ultimately understand the standards and benchmarks selected for this unit.

Big Idea(s): ____

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Unit Objective(s):

At the completion of this unit, students will be able to . . . ______________________

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APPENDIX H

Course Level Curriculum Development Workbook
Page 6

UNIT LEVEL—Define Assessment Criteria

What are the expectations for student learning? Define criteria at levels which meet, exceed, and fall below your expectations. Defining assessment criteria at various levels requires that you first determine the number of levels that will be assigned. **You may choose to use any of the three tables that follow or develop one of your own.**

Big Idea/Course Objective	Assessment Criteria		
	Below Target	**At Target**	**Above Target**

STOP! And confirm: Review the assessment criteria defined above. Verify that they:

- *Include cognitive learning elements for solving technological problems.*
- *Include psychomotor learning elements for applying technology.*
- *Include affective learning elements suitable for utilizing perspective, empathy, and self assessment.*
- *Incorporate technological problem solving.*
- *Facilitate critical thinking and decision making.*

Course Level Curriculum Development Workbook
Page 7

Big Ideas/ Course Objectives	Assessment Criteria				
	No Response	**Inadequate Response**	**Minimal Response**	**Competent Response**	**Exemplary Response**

STOP! And confirm: Review the assessment criteria defined above. Verify that they:

- *Include cognitive learning elements for solving technological problems.*
- *Include psychomotor learning elements for applying technology.*
- *Include affective learning elements suitable for utilizing perspective, empathy, and self assessment.*
- *Incorporate technological problem solving.*
- *Facilitate critical thinking and decision making.*

APPENDIX H

Course Level Curriculum Development Workbook
Page 8

Big Ideas/Course Objectives	Assessment Criteria			
	Novice	**Apprentice**	**Journeyman**	**Expert**

STOP! And confirm: Review the assessment criteria defined above. Verify that they:
- *Include cognitive learning elements for solving technological problems.*
- *Include psychomotor learning elements for applying technology.*
- *Include affective learning elements suitable for utilizing perspective, empathy, and self assessment.*
- *Incorporate technological problem solving.*
- *Facilitate critical thinking and decision making.*

Course Level Curriculum Development Workbook
Page 9

NOTE: You will need a copy of pages 9-13 for each lesson that is developed.

Plan for Instruction, Student Learning, and Assessment

Specify Lesson Duration: ____

LESSON LEVEL—Identify Standards, Then Select Benchmarks

Directions: Identify the standards that will be addressed in the lesson. Then select the benchmarks that provide further detail to your lesson. Refer to the standards and benchmarks that were identified for the unit on Page 5 of this workbook.

Standard(s) and Benchmark(s): ____

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LESSON LEVEL—Write Learning Objectives

Directions: Identify the intent of learning. Write lesson objectives that define what students should know, be able to do, and understand as a result of the lesson. Be sure to include suitable cognitive, affective, and psychomotor learning elements.

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LESSON LEVEL—Select Student Assessment Tools and/or Methods

Directions: Determine what is sufficient evidence to judge whether or not students have attained the desired understandings. Evidence refers to the information that is intended to demonstrate or prove a level of understanding.

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Course Level Curriculum Development Workbook
Page 10

LESSON LEVEL—Identify Resource Materials

Directions: List the resource materials that you will use to develop lesson activities.

Print-Based Sources (up to three)

1. ______________________________

2. ______________________________

3. ______________________________

Audio/Visual Materials (up to two)

1. ______________________________

2. ______________________________

Internet Sites (up to five)

1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

Course Level Curriculum Development Workbook
Page 11

LESSON LEVEL—Select or Develop Learning Activities

Directions: Fill in the information below to create your lesson plan. You will want to be specific about how you intend to engage students in learning.

Purpose of Lesson: ____

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Required Knowledge and/or Skills: ____

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Lesson: ____

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Course Level Curriculum Development Workbook
Page 12

LESSON LEVEL—Identify or Develop Extension Activities

Directions: Identify additional learning opportunities in which you might engage students if time allows or to extend their knowledge and abilities.

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LESSON LEVEL—Articulate Laboratory-Classroom Preparation

Directions: Identify the laboratory-classroom design and list the needed tools, materials, and equipment for effective implementation of the lesson.

Laboratory-classroom design:

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Tools/Materials/Equipment:

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LESSON LEVEL—Articulate Laboratory-Classroom Safety and Conduct

Directions: List below important "general" safety rules that must be followed in this lesson. Safety rules can relate to tools, materials, equipment, and activities.

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Course Level Curriculum Development Workbook
Page 13

List below important conduct rules that students must follow in this lesson.

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STOP! Before proceeding with the next lesson plan, go back and reconsider what additional standards and benchmarks might be effectively covered in the lesson and/or unit.

Unit Level Curriculum Development Workbook
Page 1

Team Member Information

Directions: Record team member contact information.

Team Leader: ____

Phone: ____________________ Email: ____________________

1. ____

Phone: ____________________ Email: ____________________

2. ____

Phone: ____________________ Email: ____________________

3. ____

Phone: ____________________ Email: ____________________

4. ____

Phone: ____________________ Email: ____________________

5. ____

Phone: ____________________ Email: ____________________

APPENDIX I
Unit Level Curriculum Development Workbook
Page 2

UNIT LEVEL—<u>Identify Standards, Then Select Benchmarks</u>

Directions: Identify the standards that will be addressed in the unit. Then select the benchmarks that provide further detail to your unit. It is generally recommended that you address no more than two or three standards in each unit. It is necessary to consider national, state/provincial/regional, and school district technological literacy standards as well as standards in other subject areas.

UNIT TITLE: ____

Standard(s): ____

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Benchmark(s): ____

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UNIT LEVEL—<u>Extract and Organize Content</u>

Directions: Identify the big ideas that students should learn to ultimately understand the standards and benchmarks selected for this unit.

Big Idea(s): ____

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Unit Objective(s):

At the completion of this unit, students will be able to… ________________________________

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Unit Level Curriculum Development Workbook
Page 3

UNIT LEVEL—Define Assessment Criteria

What are the expectations for student learning? Define criteria at levels which meet, exceed, and fall below your expectations. Defining assessment criteria at various levels requires that you first determine the number of levels that will be assigned. **You may choose to use any of the three tables that follow or develop one of your own.**

Big Idea/Unit Objective	Assessment Criteria		
	Below Target	**At Target**	**Above Target**

STOP! And confirm: Review the assessment criteria defined above. Verify that they:
- *Include cognitive learning elements for solving technological problems.*
- *Include psychomotor learning elements for applying technology.*
- *Include affective learning elements suitable for utilizing perspective, empathy, and self assessment.*
- *Incorporate technological problem solving.*
- *Facilitate critical thinking and decision making.*

Unit Level Curriculum Development Workbook
Page 4

Big Ideas/Unit Objectives	Assessment Criteria				
	No Response	**Inadequate Response**	**Minimal Response**	**Competent Response**	**Exemplary Response**

STOP! And confirm: Review the assessment criteria defined above. Verify that they:

- *Include cognitive learning elements for solving technological problems.*
- *Include psychomotor learning elements for applying technology.*
- *Include affective learning elements suitable for utilizing perspective, empathy, and self assessment.*
- *Incorporate technological problem solving.*
- *Facilitate critical thinking and decision making.*

APPENDIX I

Unit Level Curriculum Development Workbook
Page 5

Big Ideas/ Unit Objectives	Assessment Criteria			
	Novice	**Apprentice**	**Journeyman**	**Expert**

STOP! And confirm: Review the assessment criteria defined above. Verify that they:

- *Include cognitive learning elements for solving technological problems.*
- *Include psychomotor learning elements for applying technology.*
- *Include affective learning elements suitable for utilizing perspective, empathy, and self assessment.*
- *Incorporate technological problem solving.*
- *Facilitate critical thinking and decision making.*

Unit Level Curriculum Development Workbook
Page 6

NOTE: You will need a copy of pages 6-10 for each lesson that is developed.

Plan for Instruction, Student Learning, and Assessment

Specify Lesson Duration: ____

LESSON LEVEL—Identify Standards, Then Select Benchmarks

Directions: Identify the standards that will be addressed in the lesson. Then select the benchmarks that provide further detail to your lesson. Refer to the standards and benchmarks that were identified for the unit on Page 2 of this workbook.

Standard(s) and Benchmark(s): ____

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LESSON LEVEL—Write Learning Objectives

Directions: Identify the intent of learning. Write lesson objectives that define what students should know, be able to do, and understand as a result of the lesson. Be sure to include suitable cognitive, affective, and psychomotor learning elements.

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LESSON LEVEL—Select Student Assessment Tools and/or Methods

Directions: Determine what is sufficient evidence to judge whether or not students have attained the desired understandings. Evidence refers to the information that is intended to demonstrate or prove a level of understanding.

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Unit Level Curriculum Development Workbook
Page 7

LESSON LEVEL—Identify Resource Materials

Directions: List the resource materials that you will use to develop lesson activities.

Print-Based Sources (up to three)

1. ______________________________

2. ______________________________

3. ______________________________

Audio/Visual Materials (up to two)

1. ______________________________

2. ______________________________

Internet Sites (up to five)

1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

Unit Level Curriculum Development Workbook
Page 8

LESSON LEVEL—Select or Develop Learning Activities

Directions: Fill in the information below to create your lesson plan. You will want to be specific about how you intend to engage students in learning.

Purpose of Lesson: ____

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Required Knowledge and/or Skills: ____

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Lesson: ____

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Unit Level Curriculum Development Workbook
Page 9

LESSON LEVEL—Identify or Develop Extension Activities

Directions: Identify additional learning opportunities in which you might engage students if time allows or to extend their knowledge and abilities.

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LESSON LEVEL—Articulate Laboratory-Classroom Preparation

Directions: Identify the laboratory-classroom design and list the needed tools, materials, and equipment for effective implementation of the lesson.

Laboratory-classroom design:

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Tools/Materials/Equipment:

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LESSON LEVEL—Articulate Laboratory-Classroom Safety and Conduct

Directions: List below important "general" safety rules that must be followed in this lesson. Safety rules can relate to tools, materials, equipment, and activities.

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Unit Level Curriculum Development Workbook
Page 10

List below important conduct rules that students must follow in this lesson.

STOP! Before proceeding with the next lesson plan, go back and reconsider what additional standards and benchmarks might be effectively covered in the lesson and/or unit.

APPENDIX J

Lessons/Units/Curricula Rubric

This rubric may be used to design, refine, and evaluate new and existing technology education lesson/activities, units, and curricula that are based on *Standards for Technological Literacy: Content for the Study of Technology* (*STL*) and *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* (*AETL*). (Key: 3 is most desirable and 1 is least desirable.)

LESSON/UNIT/CURRICULA: IMPORTANT CONTENT			
DIMENSION	**1**	**2**	**3**
Lesson Purpose	**Though the big idea, concept, issue, or problem is stated, the purpose is incomplete and not fully developed.**	**The purpose describes and justifies the big idea, concept, issue, or problem but lacks coherent description of learning opportunities.**	**The description of the lesson is clear, concise, focused, and thorough. A purpose of learning opportunities in support of the big idea, concept, issue, or problem is included.**
Alignment with *STL* and State and District Standards	**The alignment is contrived.**	**The alignment with *STL* and state and district standards is clear and explicit but is not embedded in the learning opportunities for students.**	**The alignment with *STL* and state and district standards is clear and explicit throughout lesson/unit. Learning opportunities are supportive of students' attaining *STL* standards.**
Essential Questions: Learning Goals and Objectives	**The essential questions do not reflect the intended learning goals and objectives. Learning goals and objectives seem unrelated to *STL* standards; are unclear or poorly stated; appear disassociated with the big idea, concept, issue, or problem and not significant.**	**The essential questions state the learning goals and objectives in question format. Learning goals and objectives are linked to *STL* standards and are clear and significant.**	**The essential questions are related to and supportive of *STL* standards in such a way that the intent of the lesson is clear and concise. They are compelling and provide focus to drive student learning and interest in the big idea, concept, issue, or problem.**
ASSESSMENT: FREQUENT MONITORING			
Timing	**Formal assessment is limited to end-of-lesson/unit activities.**	**The lesson/unit includes diagnostic as well as end-of-unit/lesson assessment.**	**The lesson/unit is assessed from beginning to end in ways that support and measure student learning, inform teaching, and inform the learner.**
Assessors	**Only the teacher evaluates student work.**	**Students are asked to reflect in general. Students interact with peers to share and give feedback, but there is limited use of rubrics and checklists.**	**Assessment/artifacts include measures that guide student self assessment and reflection on both products and processes (example, ongoing specific questions, checklists, rubrics). Students may evaluate their own and each other's work.**
Alignment	**The assessment is unrelated to standards-based curriculum. Assessment does not measure student learning from the curriculum taught.**	**Only some aspects of standards-based curriculum are measured.**	**The assessment/artifacts are derived from *STL* and provide learning opportunities that measure and support the development of technological literacy.**

ASSESSMENT CONTINUED			
DIMENSION	**1**	**2**	**3**
Evidence of Mastery	**The assessment requires minimal responses from students. Students are limited to showing work with little or no explanation. They provide answers to multiple choice, true/false questions, or yes/no oral responses only.**	**The assessment requires some verbal/written communication on the part of the student. Student communications are limited to short test answers or question-based oral responses during presentations of work.**	**The assessment requires an elaborate response of both knowledge/skills gained and process. The communication is provided through written, artistic, oral performances, exhibitions, artifacts, and/or opportunities for students to teach.**
Audience and Purpose	**The teacher is the only audience, and the purpose of assessment is to provide a grade.**	**The purpose of the assessment/development of artifacts is vague or only school related.**	**The assessment/sharing of artifacts asks students to work for a real audience and purpose so that they can experience the benefits and consequences of their work.**
Ongoing Feedback	**Feedback on artifacts is very general or ambiguous and given after the assessment is completed.**	**The assessment/development of artifacts includes measures that provide specific feedback from the teacher after the assignment is completed. Revision is allowed but not encouraged.**	**The assessment includes measures that provide elaborate and specific feedback throughout the process from both the teacher and peers. It includes measures that encourage all students to revise in order to produce quality work.**
LABORATORY-CLASSROOM: ORGANIZATION			
Prior Knowledge	**Minimal information is conveyed for preparing learners.**	**Prior knowledge notes include prerequisites for lesson.**	**Prior knowledge notes include possible misconceptions and ideas of pre-exposure for learners.**
Resources	**Resources used are limited in scope and depth and are not related to lesson's focus. Information lacks technology tools in support of learner inquiry. There is no bibliography, or it is insufficient to prepare the teacher for the unit.**	**Resources, including technology tools, are varied and directly related to lesson's focus. The bibliography includes resources and Internet bookmarks for content and process information for teachers.**	**Resources and the bibliography are up-to-date and span a wide range of mediums and technologies that directly support student exploration and inquiry into multiple perspectives related to the lesson's focus. Resources support the teacher's needs for background information in preparation for unit/lesson implementation.**
Time	**Time allocations are unrealistic or not clearly indicated for various parts of the unit/lesson.**	**The timeframe is difficult to identify or follow for various learning opportunities and for the unit or lesson as a whole.**	**The suggested timeframe clearly specifies, in hours, the duration of learning opportunities (i.e., benchmark lessons, performance tasks, assessment) as well as estimated time for the entire unit or lesson.**
Laboratory-Classroom Preparation	**Minimal information is conveyed for preparing the laboratory-classroom.**	**Preparation notes include resources and facilities needed.**	**Preparation notes indicate helpful information on laboratory-classroom organization, resources, and facilities needed.**

DESCRIPTION OF LESSON: OPPORTUNITY TO LEARN			
DIMENSION	**1**	**2**	**3**
Rigor	**The description lacks rigor, focusing students on recall of isolated concepts, skills, or facts.**	**The description provides the teacher with information that enables students to develop a basic understanding of a big idea, concept, problem, and/or skill.**	**The description provides the teacher with information that requires students to engage in a thorough exploration of a theme, problem, issue, or question. The degree of difficulty and the complexity of content are appropriate for learners.**
Relevance	**The description includes learning opportunities presented in ways that prevent students from making meaningful connections between their own experiences and the content.**	**The description includes learning opportunities that enable students to develop an understanding and use of knowledge and skills related to a big idea, concept, issue, or problem. Tasks allow students to derive personal meaning from material studied.**	**The description includes learning opportunities that require students to engage in a thorough exploration of a topic and to draw upon student interests, backgrounds, cultures, and experiences. The learning opportunities include the opportunity to make connections with prior or future material.**
Questions	**Questions used during instruction do not reflect the big idea, concept, issue, or problem identified for the purpose of the unit/lesson. The essential questions do not serve as meaningful questions that can organize and drive the various learning opportunities of the unit/lesson.**	**The essential questions are connected and relevant to the curricular concepts but lack one or more of the five essential components listed in column 3.**	**The essential questions are (1) feasible, (2) worthwhile, (3) contextualized, (4) meaningful, and (5) sustainable. The questions are rich enough to help students learn the identified *STL* standards and help students develop technological literacy.**
Degree of Innovation	**The learning opportunities/activities demand no innovation or problem solving on the part of the student.**	**The learning opportunities demand some innovation or problem solving on the part of the student but mostly of the nature of finding out facts.**	**The learning opportunities and activities demand that students search for in-depth understanding and ability through innovation and systematic research using a variety of sources, strategies, and technological problem-solving methods.**
Sequence of Content and Process	**The unit or lesson has no clearly defined structure, or the structure is chaotic.**	**The unit or lesson has a recognizable structure with substantial content subsumed under the essential questions.**	**Flow of activities is logical and likely to engage students in meaningful activities. Concepts are carefully sequenced and integrated with substantial content derived from the essential questions. Learning opportunities support several learning styles/intelligences. Learning opportunities from one part of the unit or lesson connect with other parts. Unit or lesson includes benchmark lessons as appropriate. Activities support the whole with questions from one part of the unit or lesson connected with others. Students explore a topic from many different angles and understand the relationship of the parts to the whole.**

DESCRIPTION OF LESSON CONTINUED			
DIMENSION	**1**	**2**	**3**
Grouping Strategies	**The unit or lesson addresses one of the following at the exclusion of the others—individual, collaborative, or competitive learning. The form of learning used is not connected in meaningful ways to study of content.**	**Students are directed to work individually and in groups, but the learning is not maximized or linked clearly to show evidence of content mastery.**	**Students are guided to work in individual, collaborative, and competitive tasks and activities. There is both individual accountability and group interdependency. There are opportunities for students working with students and with teachers as well as students and teachers working with the community. Students are encouraged to lead the learning and share their findings.**
Lesson Extension(s)	**The extension seems to be a "tack on" with little or no thought to how it enhances or supports the unit or lesson.**	**The extension(s) are written to show how they will enhance or support deeper student understanding but not sufficient to address higher expectations.**	**The extensions are designed and sequenced to engage students in sophisticated explanation, masterful application, and insightful perspective. The extensions provide students with an opportunity to go beyond the confines of the unit or lesson and to explore the big idea, concept, issue, or problem in more depth.**
Benchmark Suggestions	**Specific teacher designed tasks or activities that focus on student attainment of the benchmarks are not well developed in the unit or lesson.**	**Teacher designed tasks specific to the identified benchmarks are included but not sufficient to address anticipated subtopics of essential questions.**	**Teacher designed tasks and activities specific to the identified benchmarks are sequenced and integrated through the unit or lesson.**

APPENDIX K

Checklist for Evaluating Standards-Based Curricula, Courses, Units, or Lessons

Directions: Use the checklist to determine what areas of the curriculum, course, unit, or lesson or groups of lessons need to be revised in order to be in alignment with *Standards for Technological Literacy: Content for the Study of Technology* (*STL*). Circle "yes" or "no" to record your responses. Those areas you have identified with a "no," you will need to modify and adjust in order to conform to *STL*.

I. Introductory Components

Yes No 1. Is the course title appropriate?

Yes No 2. Is the table of contents appropriate?

Yes No 3. Are the curriculum team members appropriate for this curriculum guide?

II. Standards-Based Curriculum Matrix

Yes No 1. Is the curriculum matrix for *STL* completed thoroughly and accurately?

Yes No 2. Is the curriculum matrix for other discipline standards completed thoroughly and accurately?

III. Course Description

Yes No 1. Is the name of the course appropriate for what was stated in the curriculum guide?

Yes No 2. Is the intended audience correct for this course?

Yes No 3. Is the purpose of the course state accurately?

Yes No 4. Is the course placed correctly within the overall school program?

Yes No 5. Is the course overview accurate?

IV. Mission

Yes No 1. Is the brief philosophy of the discipline appropriately stated?

Yes No 2. Is the mission of the course compelling?

V. Goals and Objectives

Yes No 1. Are the major cognitive course goals stated appropriately?

Yes No 2. Are the major performance objectives (doing) appropriate?

VI. Course Assessment: Activities, Projects, Student Self Assessment, Tests, Etc.

Yes No 1. Are the major course performance tasks and projects accurately stated?

Yes No 2. Are the written assessment items accurately stated?

VII. Course Outline

Yes No 1. Are the course units totally inclusive of the overall scope of the course?

Yes No 2. Are the related lessons within each unit inclusive for that unit?

VIII. Standards-Based Unit/Lesson Template

A. Read/Review *Purpose*

Yes No 1. Read the purpose of the lesson. Do you understand the "Big" idea?

Yes No 2. In a few words, write down the "Big" idea of the lesson.

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Yes No 3. Do you feel that the lesson is doable?

B. Read/Review standards in *Standards for Technological Literacy* that are addressed.

Yes No 4. Is the grade level clearly marked?

Yes No 5. Are the standards clearly labeled?

Yes No 6. Are the benchmarks clearly labeled?

Yes No 7. Do the standards and benchmarks align with *STL*?

Yes No 8. Are the identified standards appropriate for the given purpose?

Yes No 9. Are the identified benchmarks appropriate for the given purpose?

__________ 10. How many standards and benchmarks are addressed?

Yes No 11. Are there more than two or three standards addressed?

Yes No 12. Are there other standards (e.g., state standards, standards in other disciplines, etc.) addressed?

If, yes, what do they address?

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Yes No 13. If there are standards listed besides those from *STL*, how do the standards support each other?

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C. Read/Review *Essential Questions*

Yes No 14. Are the "essential questions" phrased as questions?

Yes No 15. Do the "essential questions" link back to the identified standards and benchmarks?

Yes No 16. Do the "essential questions" provide evidence of understanding?

Yes No 17. Do the "essential questions" identify the "knowing" and "doing" required for technological literacy?

D. Read/Review *Assessment*

Yes No 18. Are appropriate assessment method(s) used?

Yes No 19. Are the standards and benchmarks identified in the lesson accurately measured by asessment?

Yes No 20. Is cognitive learning measured by assessment?

Yes No 21. Is psychomotor learning measured by assessment?

E. Read/Review *Prior Knowledge*

Yes No 22. Is prior knowledge presented?

Yes No 23. Is the prior knowledge presented relevant to the needs of the lesson?

F. Read/Review *Resources and Time*

Yes No 24. Does the lesson include appropriate resources?

Yes No 25. Does the lesson provide adequate time to ensure understanding of the standards and benchmarks?

Yes No 26. Are citations provided for copyrighted materials?

G. Read/Review *Description of Lesson and Related Activity*

Yes No 27. If you gave this lesson to another *qualified teacher*, could that person "teach" the lesson?

Yes No 28. Are the "Six Facets" of understanding (*1. Explanation, 2.Interpretation, 3. Application, 4. Perspective, 5. Empathy, and 6. Self Knowledge*) covered in this lesson?

H. Read/Review *Extension*

Yes No 29. Are the extension suggestions plausible?

Yes No 30. Is the lesson relevant to the curriculum?

IX. Resource Materials

Yes No 1. Are the print-based materials suitable for this course?

Yes No 2. Are the audio-visual materials appropriate for this course?

Yes No 3. Are the computer-related programs appropriate for this course?

Yes No 4. Are the Internet sites suitable for this course?

X. Instructional Strategies

Yes No 1. Are the instructional strategies appropriate for this course?

XI. General Safety and Conduct Rules

Yes No 1. Are the general safety rules correct for this course?

Yes No 2. Are the student conduct rules appropriate for this course?

XII. Facility Design

Yes No 1. Is the design of the laboratory-classroom suitable for this course?

Yes No 2. Are the tools/materials/equipment listed appropriate for this course?

XIII. Evaluation of the Course

Yes No 1. Are the items listed for effectively evaluating the course appropriate?

XIV. Appendices of Curriculum Guide

Yes No 1. Is there a course syllabus appropriate for the course?

Yes No 2. Are other components such as activities and vitae of team members available in the appendix?

Overall Summary of Evaluation (Provide overall summative evaluation comments)

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APPENDIX L

References and Resources

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APPENDIX M
Glossary

The terms defined in this glossary apply specifically to *Planning Learning: Developing Technology Curricula*. These terms may have different meanings in different situations.

Some Acronyms Used in this Publication

AAAS American Association for the Advancement of Science
AETL *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards*.
CATTS Center to Advance the Teaching of Technology and Science
GESP Geography Education Standards Project.
ISTE International Society for Technology in Education.
ITEA International Technology Education Association.
NASA National Aeronautics and Space Administration.
NCHS National Council of History Standards.
NCTE National Council of Teachers of English.
NCTM National Council of Teachers of Mathematics.
NRC National Research Council.
NSF National Science Foundation.
NSTA National Science Teachers Association.
STL *Standards for Technological Literacy: Content for the Study of Technology.*
TfAAP Technology for All Americans Project.

General Glossary Terms

Ability — The capacity to determine the application of knowledge and skills.

Accreditation — A system designed to attest to the act of accrediting or the state of being accredited. An accreditation system would involve the approval of an institution of learning as meeting a prescribed standard or standards through a review board.

Across grade levels — Inclusive of all grades specified in the identified levels of an institution of learning, such as across grades kindergarten through twelve for public education.

Action plan — A management strategy that includes program mission statements, goals, short- and long-range strategic planning, organization, evaluation, and responsibilities.

Activity — A named process, function, or task that occurs over a period of time and has recognizable results.

Action research — Inquiry-based research conducted by teachers that follows a process of examining existing practices, implementing new practices, and evaluating the results, leading to an improvement cycle that benefits both students and teachers.

Administrator — Professional who manages any aspect of the educational system, including supervisors and teachers as appropriate.

Advisory committee — An organized body comprised of informed and qualified individuals with a specified responsibility to give advice in the development of an idea or process. Members may include parents, business and industry personnel, local engineers, technologists, and interested individuals.

Affective — Relating to, arising from, or influencing feelings or emotions.

Articulated/Articulation — A planned sequence of curricula and course offerings from Grades K–12. The planned sequence may involve looking at course offerings across grade levels (vertical articulation) or the curriculum at a single grade level (horizontal articulation).

Assessment — 1. See student assessment. 2. See evaluation. Note: *Planning Learning* differentiates between assessment and evaluation, taking the position that students are assessed and programs are evaluated.

Assessment criteria — The expectations of student learning that are used for collecting information on student learning. They define what a student should know, understand, and be able to do and can be measured and/or observed.

Assessment method — Any of the techniques used by teachers that enable students to demonstrate understanding (i.e., open-ended questioning, observation, etc.)

Assessment tool — Any of the instruments completed by students that enable them to demonstrate their understanding (i.e., multiple-choice test, design brief, etc.).

Audience — Those for whom material is intended.

Benchmark — In *Standards for Technological Literacy: Content for the Study of Technology* (ITEA, 2000/2002), it is a written statement that describes the specific developmental components by various grade bands (K–2, 3–5, 6–8, and 9–12) that students should know or be able to do in order to achieve a standard.

Big ideas — The large, important, profound, and lasting ideas that will endure over a long period of time.

Checklist — An evaluative tool, which can take many forms, from a simple listing to a formal quarterly report of progress.

Cognitive — 1. Having a basis in or being reducible to empirical, factual knowledge. 2. A teaching method that recognizes the close relationship between what is known and what is to be learned. The teaching proceeds to build on the student's knowledge base by helping the student associate new material with something that is familiar.

Collaboration — A cooperative relationship that enables goals to be accomplished more effectively and comprehensively than by individual efforts.

Commonality — Similarity of interests, cultures, abilities, socio-economic backgrounds, and/or special needs.

Community — A body of people living in the same place under the same laws.

Conduct rules — A mode or standard of personal behavior, such as how to act in the laboratory-classroom or what proper safety precautions to take in the use of tools and equipment.

Content — See content standards.

Content standards — 1. The standards in *Standards for Technological Literacy: Content for the Study of Technology* that provide written statements of the knowledge and abilities students should possess in order to be technologically literate. 2. The standards in other content areas that specify what students should know and be able to do, including those in *National Science Education Standards* or *Principles and Standards for School Mathematics*.

Continuous — Uninterrupted in time, sequence, substance, or extent.

Course — A series of units that lasts for a specified period of time (semester, year, etc.) and is designed around a specified school subject.

Course outline — The list of the components in a course that defines the scope and content of the course.

Course purpose — A written statement that states the benefits of a course for various audiences.

Criteria — Desired specifications (elements or features) of a product or system.

Curriculum/Curricula — Specification of the way content is delivered, including the structure, organization, balance, and presentation of content in the laboratory-classroom.

Curriculum development — The process of creating planned curriculum, pedagogy, instruction, and presentation modes.

Curriculum goal — Broad written statements on what students will know and be able to do at the end of a curriculum.

Curriculum objective — The specific measures the teacher uses to determine whether or not students are successful or not in achieving the curriculum goal(s).

Data collection — Procedure in which data from various sources are accumulated.

Decision makers — Those responsible for examining several possible behaviors and selecting from them the one most likely to accomplish the individual's or group's intention. Cognitive processes such as reasoning, planning, and judgment are involved.

Design — An iterative decision-making process that produces plans by which resources are converted into products or systems that meet human needs and wants or solve problems.

Design process — A systematic problem-solving strategy, with criteria and constraints, used to develop many possible solutions to a problem or to satisfy human needs and wants and winnow (narrow) down the possible solutions to one final choice.

Developmentally appropriate — Intended to match the needs of students in the areas of cognition, physical activity, emotional growth, and social adjustment.

Disciplines — Specified realms of content.

Diversity — Differences of interests, cultures, abilities, socio-economic backgrounds, and/or special needs.

Educational standards — See standard.

Educational (instructional) technology — 1. The study of computers and other media. 2. The use of technological developments, such as computers, audiovisual equipment, and mass media, as tools to enhance and optimize the teaching and learning environment in all school subjects, including technology education.

Educators — Those professionals involved in the teaching and learning process, including teachers and administrators.

Effective — Produces the desired results with efficiency.

Embedded — To set or fix firmly into a statement or activity.

Engineering design — The systematic and creative application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems.

Equitable — Fair, impartial, or just.

Essential questions — These questions probe for deeper meaning and set the stage for further questioning to promote the development of critical thinking skills and higher order capabilities, such as problem solving and understanding complex systems.

Evaluate/Evaluation — Collection and processing of information and data to determine how well a design meets the requirements and to provide direction for improvements. Note: *Planning Learning* differentiates between assessment and evaluation, taking the position that students are assessed and programs are evaluated. See also program evaluation.

Evaluation principles — The basic truths, laws, or assumptions held in the use of evaluation.

Evidence — The information that is intended to demonstrate or prove a level of understanding.

Expectations — Anticipated action that demonstrates understanding.

Facility design — The planning, development, and implementation process which will lead to new or remodeled technology education learning environments (laboratory-classrooms).

Fair — Not biased or discriminatory.

Feedback — Using all or a portion of the information from the output of a system to regulate or control the processes or inputs in order to modify the output.

Flexibility — The quality of being adaptable or variable.

Formative evaluation — Ongoing evaluation of the program and its components. It provides information to educators and other concerned individuals on revising the overall program.

Formative student assessment — Ongoing student assessment in the classroom. It provides information to students and teachers to improve teaching and learning.

Goal — The expected end result. In standards-based education, this can be specifically applied to learning, instruction, student assessment, professional development, and program enhancement.

Grade level — 1. A stage in the development of a child's education (i.e., K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12). 2. From grade to grade and across grade bands (i.e., Grades 2–3 or Grades 3–5).

Guideline — 1. In *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* (ITEA, 2003), it is a specific requirement or enabler that identifies what needs to be done in order to meet a standard. 2. A suggestion to consider.

Implement/Implementation — To proceed with practical application.

Innovation — An improvement of an existing technological product, system, or method of doing something using both natural resources and human resources.

Inputs — Something put into a system (such as resources) in order to achieve a result.

In-service — 1. A practicing educator. 2. Workshops, lectures, and other educational opportunities designed to keep practicing professionals abreast of the latest developments in their fields.

Instruction — The actual teaching process that the teacher employs to deliver the content to all students.

Instructional methods — Processes by which knowledge, abilities, and attitudes are deliberately taught and evaluated.

Instructional strategies — All of the elements necessary in the teaching and learning process. This includes curriculum development, laboratory-classroom planning, and evaluation, in addition to the delivery system to be used in the teaching process.

Instructional (educational) technology — 1. The study of computers and other media. 2. The use of technological developments, such as computers, audiovisual equipment, and mass media, as tools to enhance and optimize the teaching and learning environment in all school subjects, including technology education.

Integrated/Integration — The process of bringing all parts together into a whole.

Internship — Any agreed-upon experiences in a work setting that is driven by intentional learning goals and accompanied by sustained reflection. What distinguishes an internship from a job is that first and foremost it is a deliberate learning experience.

Interview — A form of discussion that includes a planned sequence of questions, similar to a job interview. Students are not given information, as the objective is to collect data on student knowledge and abilities at a certain point in time.

Invention — A new product, system, or process that has never existed before, created by study and experimentation.

Journal — A record of understandings, reflections, and/or opinions written as periodic entries (daily, weekly).

Knowledge — 1. The body of truth, information, and principles acquired by mankind. 2. Interpreted information that can be used.

Laboratory-classroom — The environment in which student learning related to the study of technology takes place. At the elementary school level, this environment will likely be a regular classroom. At the middle and high school levels, a separate laboratory-classroom with areas for hands-on activities as well as group instruction, could constitute the environment.

Learning activities — Experiences provided to students that enable them to gain understandings.

Learning environment — Formal or informal location where learning takes place that consists of space, equipment, resources (including supplies and materials), and safety and health requirements.

Lesson — Day-by-day plan for learning in the classroom.

Level of understanding — A degree of knowledge and/or ability that indicates understanding.

Market/Marketing — The act of encouraging others to buy a product or accept an idea or concept.

Mathematics — The study of abstract patterns and relationships that results in an exact language used to communicate about them.

Measurements — Collecting data in a quantifiable manner.

Mentoring — Mentoring is an educational process where the mentor serves as a role model, trusted counselor or teacher who provides opportunities for professional development, growth and support to less experienced individuals in career planning or employment settings. Individuals receive information, encouragement, and advice as they plan their careers.

Mission (statement) — The articulation of organized goals and strategies for realizing goals.

Modification — 1. Changing to ensure accuracy. 2. Adjustment in focus or level of rigor.

Objective — A specific item or procedure that meets a designated goal.

Observation — The act or practice of noting and recording facts and events.

Outcome — A term used to indicate the result or the expected result of an educational plan or program. Outcomes can also be the consequences of decisions made.

Partnerships — A relationship between teacher candidates or teachers and technology professionals in business, industry, and higher education, among others that builds a connection to the technological world beyond the classroom.

Plan/Planning — A set of steps, procedures, or programs worked out beforehand in order to accomplish an objective or goal.

Presentation — An assessment approach that involves the performance or delivery of information.

Portfolio — An assessment approach that involves the formal or informal, systematic, and organized collection of student work that includes results of research, successful and less successful ideas, notes on procedures, and data collected. A portfolio may be in many forms, from photographs depicting student growth and understanding to a specialized electronic journal showing work completed over a period of time.

Pre-service — 1. A teacher candidate. 2. Undergraduate education for those who intend to teach.

Priorities — The imposed sequences desired with respect to the scheduling of activities within previously imposed constraints.

Prior knowledge — A combination of the learner's preexisting knowledge, abilities, attitudes, and experiences.

Problem solving — The process of understanding a problem, devising a plan, carrying out the plan, and evaluating the plan in order to solve a problem or meet a need or want.

Process — 1. Human activities used to create, invent, design, transform, produce, control, maintain, and use products or systems. 2. A systematic sequence of actions that combines resources to produce an output.

Product — A tangible artifact produced by means of either human or mechanical work, or by biological or chemical processes.

Professional development — A continuous process of lifelong learning and growth that begins early in life, continues through the undergraduate, pre-service experience, and extends through the in-service years.

Professional organizations — Organizations of and for professional people.

Program — Everything that affects student learning, including content, professional development, curricula, instruction, student assessment, and the learning environment, implemented across grade levels.

Program evaluation — Collection and processing of information and data to determine how well all components of the program—including content, professional development, curricula, instruction, student assessment, and the learning environment—meets the requirements and to provide direction for improvements.

Project — A teaching or assessment method used to enable students to apply their knowledge and abilities. These may take many forms and are limited by time, resources, and imagination.

Psychomotor — 1. Physical behavior that has a basis in mental processes. 2. A teaching method that involves both mental processes and physical movement.

Reliable/Reliability — Capable of being relied upon; dependable; may be repeated with consistent results.

Research — Systematic, scientific, documented study.

Research and development (R&D) **—** The practical application of scientific and engineering knowledge for discovering new knowledge about products, processes, and services and then applying that knowledge to create new and improved products, processes, and services that fill market needs.

Resource — The things needed to get a job done. In a technological system, the basic technological resources are: energy, capital, information, machines and tools, materials, people, and time.

Rubric — An assessment or evaluative device based on the identified criteria taken from the content standards. Points or words are assigned to each phrase or level of accomplishment. This method gives feedback to the students about their work in key categories, and it can be used to communicate student performance to parents and administrators.

Safety — The opposite of risk. It is the probability that harm will not occur under specified conditions.

Science — Understanding the natural world.

Society — A community, nation, or broad grouping of people having common traditions, institutions, and collective activities and interests.

Stakeholders — Individuals or entities who have an interest in the success of a specific venture or program. Stakeholders in technology education may include teachers, administrators, school leaders, professional development providers, business and industry leaders, engineers, scientists, technologists, and others.

Standard — A written statement or statements about what is valued that can be used for making a judgment of quality.

Standards-based — Educational standards provide the content basis on which student learning is built. Everything that affects student learning is planned to support students as they attain standards.

Standards-based reform — An educational movement that supports maintaining high academic expectations, or standards, for all students that holds schools, teachers, and students accountable for student learning and achievement.

Standards-reflected — A connection is made to educational standards, but standards do not necessarily provide the basis for student learning. Teaching and assessment of standards is "hit or miss."

Strategy/Strategies — An elaborate and systematic plan of action.

Student assessment — A systematic, multi-step process of collecting evidence on student learning, understanding, and abilities and using that information to inform instruction and provide feedback to the learner, thereby enhancing learning.

Student learning — The act or process of acquiring knowledge or skill.

Study of technology — Also referred to as technological study. Any formal or informal education about human innovation, change, or modification of the natural environment. See also technology education.

Summative evaluation — Cumulative evaluation of the program and its components. It provides information to educators and other concerned individuals on revising the overall program.

Summative student assessment — Cumulative student assessment that usually occurs at the end of a unit, topic, project, or problem. It identifies what students have learned and also judges student performance against previously identified standards. Summative student assessment is most often thought of as "final exams," but it may also be a portfolio of student work.

Sustainable/Sustainability — An action or process that is capable of continuing indefinitely.

System — A group of interacting, interrelated, or interdependent elements or parts that function together as a whole to accomplish a goal.

Systematic — Occurring on a regular basis; having a plan or order.

Teacher education — The in-service and pre-service education of teachers.

Teacher educators — Individuals who deliver pre-service and in-service teacher education, including, but not limited to, college and university faculty.

Teaching — The conscious effort to bring about learning in a manner that is clearly understood by the learner and likely to be successful.

Technological literacy — The ability to use, manage, understand, and evaluate technology.

Technological literacy standards — The standards in *Standards for Technological Literacy: Content for the Study of Technology* and *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* that identify the content and provide criteria for the implementation of that content for developing technological literacy.

Technological study — See technology education.

Technology — The innovation, change, or modification of the natural environment to satisfy perceived human needs and wants.

Technology education — A school subject specifically designed to help students develop technological literacy.

Technology program — Everything that affects student attainment of technological literacy, including content, professional development, curricula, instruction, student assessment, and the learning environment, implemented across grade levels as a core subject of inherent value.

Technology program advisory committee — An ongoing and continuous committee that oversees the technology program and assists the Technology Program Committee as it makes important decisions, ensuring that school and community concerns are addressed.

Technology program committee — A working group that establishes the focus and direction of the technology program.

Test — 1. A method for collecting data. 2. A procedure for critical evaluation.

Troubleshooting — Locating and finding the cause of problems related to technological products or systems.

Understanding — A synthesis of knowledge and abilities that involves sophisticated insights and is reflected through performance in various contexts.

Unit — An organized series of learning activities, lectures, projects, and other teaching strategies that focuses on a specific topic related to the curriculum as a whole.

Valid/Validity — Having or containing premises from which the conclusion may logically be derived, correctly inferred, or deduced.

Vignette — A brief description or verbal snapshot of how a standard or group of standards may be implemented in the laboratory-classroom.

Vision — A contemplative image of future promise and possibility articulated with the intention to inspire others.

Workshop — A meeting or series of meetings devoted to discussion and demonstration of practical applications in a specialized field or subject.

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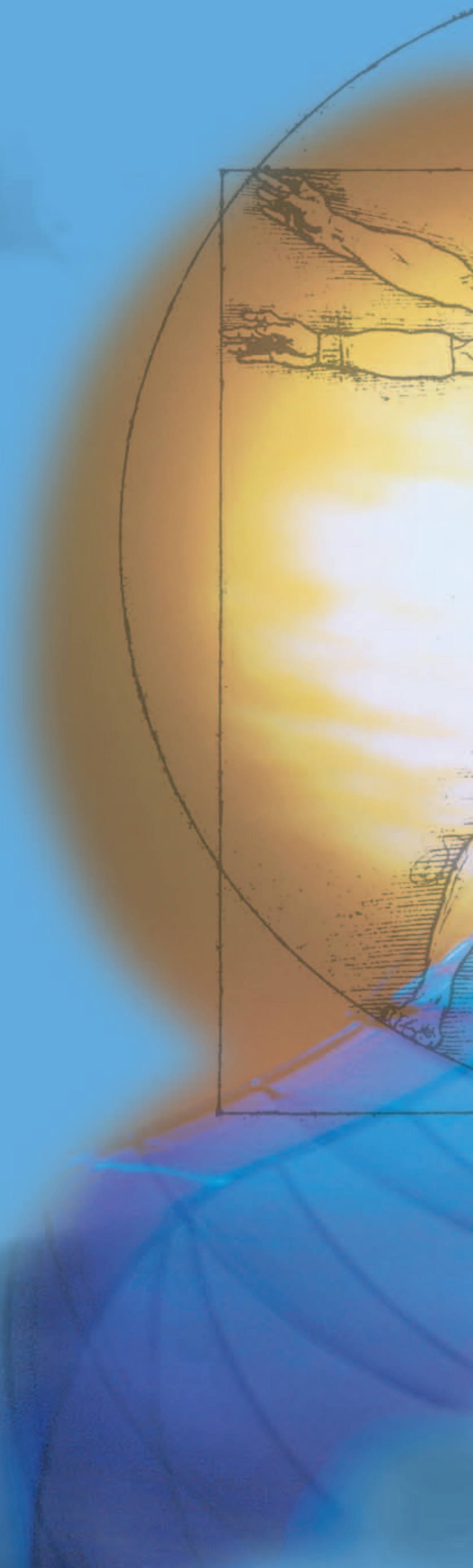

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