New Hampshire

Technology/Engineering Education

Curriculum Guide

State of New Hampshire
Department of Education

New Hampshire Technology Education Association

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Introduction

Foreword to the 2001 Edition

Fifty years ago all a teacher of Industrial Arts needed was a collection of project plans and operation sheets to implement a shop-oriented program of hands-on activities. Students in the subject areas enjoyed the individual creative work and always liked taking home to parents the finished products of their labors from the drafting and graphic arts rooms, and wood and metal shops of junior and senior high schools.

Then, in the sixties and seventies, many curriculum innovators pushed to shift the curricular emphasis from the "arts" to the "industrial" nature of the program. Numerous attempts to provide a new direction included the Maryland Plan, Orchestrated Systems, Industrial Arts Curriculum Project, American Industry Project, and Industriology. Each program revision provided a unique emphasis while most included the industrial areas of construction, manufacturing, communication, and transportation. These programmatic "revolutions" provided the "evolutions" that formed the revised program and included such activities as production lines, structure building, and group projects, to name a few.

The decades of the eighties and nineties fostered another curriculum renewal, emphasizing the "technology" that was always inherent in the industrial programs of previous years. Computers were incorporated into instruction and students participated in instrumentation, robotics, graphic design work, publications, and engineering simulations.

In the past, the "graduation" of new teachers marked the completion of a program of studies wherein little change was required or expected during a career. Now, the "commencement" of professional educators establishes the beginning of a career of constant change--one demanding life-long learning of instructors. In order to stay current, technology educators must be open to these changes and to the new and better ways of assisting learners in their quest for technological literacy--understanding the nature of civilization in the twenty-first century.

Herein are many suggestions for updating programs in Technology Education. Read through them carefully and do everything possible to incorporate them in new and evolving programs under your care. Your students will learn more about the contemporary state of the technological society, one in which they will spend the rest of their lives.

Robert C. Andrews, Ed.D.
Professor Emeritis
Keene State College

Foreword to the 2008 Guide

This Curriculum Guide is first and foremost a professional work done by the technology education teachers of New Hampshire. It is the fourth of a series of guides developed by members of the profession since 1983, and presents the content of educational experiences which will provide for the development of engineering and technological literacy for New Hampshire students. It is designed as a guide in that it is not a prescribed curriculum, but it is a reflection of current national thinking about the content universe of engineering and technology education. It is unique in that it was developed by professional educators in New Hampshire for New Hampshire schools and takes into account the specific needs and conditions of New Hampshire at the present. Please see the list of educators who have contributed to this Guide listed elsewhere.

This document is the result of much work by many individuals. Significant support has been received by the New Hampshire Technology Education Association in the completion of this work. The New Hampshire Department of Education has contributed personnel and resources, and the New England Association of Technology Teachers has provided resources, and most importantly, the professional educators in technology education in New Hampshire have contributed time, energy and commitment to this project. It is their Guide.

The intended purpose of this document is to help educators provide experiences which increase technological literacy for all learners in our schools. It deserves the careful and thoughtful review by all educators who bring technological literacy to learners in New Hampshire. I am confident that its use will prove beneficial in this effort.

Ed W. Taylor, PhD
Curriculum Supervisor
New Hampshire Department of Education

Preface to revised edition

The *New Hampshire Technolog/Enginering Education Curriculum Guide* was developed to provide a rationale for Technology/Engineering Education. This guide reflects the national *Standards for Technological Literacy: Content for the Study of Technology* produced by the International Technology Education Association (ITEA), and the philosophy set forth by the New Hampshire Technology Education Association. This guide is intended to assist in the process of developing and improving a K-12 Technology/Engineering Education program. In kindergarten through fifth grade an introduction to technological literacy can be accomplished through activities integrated into the regular curriculum. The certified Technology Education teacher can meet with students or may serve as a "consultant/facilitator" or guide for the regular elementary teachers as they make Technology/Engineering Education a part of the curriculum. In each elementary and middle school a technology education program is required to provide instruction to enable students to develop an understanding of the technological world in which they live and will someday work. *(Ed 306.47,a.1-a.4).* In grades nine through twelve it is required that four units of credit in technology education be among the program areas offered by each high school. *(Ed 306.47,b.4).*

This guide was developed for use in applying the principles of effective and efficient curriculum design to the field of Technology/Engineering Education and assist teachers to create and implement the best possible programs for their students. Using this guide, teachers will be able to reevaluate their current methodologies and curriculum. It is important to remember that curriculum must evolve to accommodate the ever-changing needs of the students it serves. The ultimate goal of Technology Education is to help all students become productive citizens and develop an understanding of technology's role in society.

Historical Perspective

Early Beginnings

Technology is a basic human activity, a root of human development throughout history. Mainly concerned with filling basic needs such as food, clothing, and shelter, early humans survived by developing tools and techniques that allowed them to overcome their physical deficiencies. They were not only making tools and weapons from wood, hides, bone, and stone; they were passing the knowledge of these techniques to their young, creating sustainable cultures. From generation to generation, education by imitation was the only viable means of passing on the tools and skills for survival in a hostile environment. Over the centuries very little refinement took place in the design of the basic implements until humans began to specialize in the production of a particular article. The development of individual aptitudes, as evidenced by skillfully constructed products, initiated economic systems of exchange, and artisans became known for their accomplishments and contributions to the common good. As time went on, specialized skills were passed to succeeding generations through the apprenticeship system, but the roots of Technology Education, as we know it today, can be traced to the nineteenth century.

Scandinavian Sloyd

Scandinavian farming families, needing constructive pursuits during long winter evenings, found much satisfaction in the useful handwork of woodcarving. Furniture, household articles, and tools were carved from native woods for use in the home and on the farm. By 1800, this practice of handwork, or "*sloyd*", had become a major component of the culture of Sweden and Finland. As farmer-craftsman developed individual talents and unique products, **home sloyd**, a system of usufacture (production for use), evolved into **domestic industries**, a precursor to the factory system and manufacturing (production for distribution). The advent of the industrial revolution, with mechanized production, brought the home-based era to a gradual close, but due to the developmental values inherent in constructive activities, **educational sloyd** was established as a school-based system of formative education. Uno Cygnaeus of Finland and Otto Salomon of Sweden were the major leaders in the development of a systematic program for the elementary schools, emphasizing the usefulness of constructed articles through formal educational methodology.

Mechanic Arts

Founded to train Russian engineers, draftsman, and chemists, the Imperial Technical School of Moscow was the first to replace the apprenticeship method with a pedagogically sequenced program of studies, simple to complex, employing classroom instruction separate from construction shops. While imitation had previously been the main method of skill and information acquisition, Victor Della Vos and his instructors required students to pass an organized program of activities, thereby shortening the time required to learn the mechanic arts. Whereas the formal apprenticeship system was severely limited in the number of learners that could be instructed by a single craftsman, this new method allowed one master craftsman to teach a relatively large number of students simultaneously. Individual student achievement could also be more easily and accurately evaluated by the instructor. In 1876, Della Vos and his colleagues, created the Russian Exhibit of Mechanic Art, a display of student products, for the Centennial Exposition in Philadelphia. This exhibit was to exercise a great deal of influence on the American system of Manual Training.

Manual Training
At about this time, Calvin Woodward of Washington University in St. Louis and John Runkle of the Massachusetts Institute of Technology sensed a deficiency in the educational preparation of engineers at their respective institutions. There existed a general lack of practical experience with tools, machines, and materials, necessitating lengthy post-graduate apprenticeships before students could be recognized as independent practicing engineers. The Russian Exhibit of Mechanic Arts, previously mentioned, provided reinforcement for their ideas and the impetus to reorganize engineering education, incorporating the principles associated with sloyd and the mechanic arts. Eventually this resulted in a relatively new system of manual training in higher education as well as at the secondary level. The Manual Training School of St. Louis and Boston Trade High School resulted from their endeavors, providing the impetus to build many similar secondary schools throughout the nation. The success of practical education continued to illustrate the need for integrating tools, materials, and manipulative activities into the traditional program of academic studies.

Manual Arts
In the 1890s John Ruskin and William Morris founded the Arts and Crafts Movement in England. They were reacting to those aspects of the Industrial Revolution which they perceived had a dehumanizing effect on society. With its emphasis on creativity and aesthetics, the Arts and Crafts Movement reached the United States where Charles Bennett instituted a new subject area concerning the arts of industry. It included **graphic arts**—embracing all forms of drawing and illustration, **mechanic arts**—dealing with production of wood and metal articles, **plastic arts—**including work with ductile materials such as clay and concrete, **textile arts—**with activities in spinning, weaving, basketry, and garment making, **bookmaking arts**—concerned with printing and bindery experiences, and **culinary arts**—dealing with aspects of food preparation. The structure was so comprehensive that many of the titles were widely accepted and used in future programmatic transitions. Bennett's philosophy was mainly concerned with education as preparation for life. He felt that all learning experiences in the schools should be directed toward the fulfillment of that most important goal.

Industrial Arts
In 1913, Fredrick Bonser and Lois Coffey Mossman established the framework for Industrial Arts as a separate subject at the Teachers College of Columbia University. Working mainly with elementary school students and teachers, they promoted the idea that students should become producers before participating in society as adult consumers. Thus, as members of an industrial society, they would have a greater awareness and deeper understanding of the methods of industrial production used to fill human needs and wants. Their definition of Industrial Arts, "those occupations by which changes are made on the forms of materials to increase their values for human usage… and of the problems of life related to those changes" provided a foundation for curriculum development. The project became the principal means of teaching and learning, and instructors were encouraged to integrate academic subjects with Industrial Arts. Seven subject areas evolved, including woodworking, mechanical drawing, metalworking, graphic arts, industrial crafts, power mechanics, and electricity. With the launch of Sputnik by the Soviets, a re-evaluation of objectives and content occurred during the 1950s and 1960s, ushering in an age of experimentation associated with the technological nature of contemporary culture. Subject areas expanded to include line production, transportation, industrial plastics, and electronics. The foundation was laid for the prolific development of innovative programs and the eventual curricular transformation to Technology Education.

Vocational-Industrial Education
The United States was increasingly turning from an agricultural society into a full participant in the Industrial Revolution begun in England. This increase in industrial activity required a workforce trained to the demands of the factory model of production. The passage of the Smith-Hughes Act (1917) provided for the development of special schools and training programs for vocational preparation. This first federal aid program to vocational education forced the manual education movement to re-examine its goals in light of society's needs for occupational orientation and trade preparation. Through a series of amendments to the original legislation, as well as subsequent acts, vocational education has continued to expand and flourish with the national emphasis on career development (orientation, exploration, preparation, and specialization), as well as programs for the disadvantaged and handicapped. One outcome of the Smith-Hughes Act, however, was that vocational education and Industrial Arts had a tendency toward converging development. This occurred in part because the schools where teachers received their training tended to create a single program to train the teachers in both disciplines. As a result, Industrial Arts migrated from its origin as part of the progressive elementary education movement to its perception as a pre-vocational program in the high school curriculum.

Technology Education
Throughout history, humans have been producers, builders, communicators, consumers, and travelers. During this century, however, the manner in which these activities have been conducted has undergone rapid change. These changes have been caused by the phenomenon known as technology. Through technology, human potential has been multiplied many times. Because of technology, humans can now engage in virtually instant worldwide communication, travel faster than the speed of sound and, build structures and produce durable goods through a high degree of automation. Technology has truly changed the way we live. Since technology has had, and continues to have, an enormous impact on our way of life, it seems appropriate for all persons to be able to understand and use technology.

Technology Education, as a curricular area within the schools, is designed to meet this challenge. In 1996 the International Technology Education Association published the document *Technology for All Americans: A Rationale and Structure for the Study of Technology*. This document outlines the reasons for and basic principles behind the study of technology. It was used to guide the development of *Standards for Technological Literacy: Content for the Study of Technology.* This document was released in 2000. It describes five major categories of study in Technology Education: The Nature of Technology, Technology and Society, Design, Abilities for a Technological World, and The Designed World. Each category is then broken down into the Standards for Technological Literacy. These twenty Standards are further refined into measurable benchmarks for Grades K-2, 3-5, 6-8, and 9-12. This has given Technology Education teachers a road map to follow when developing curriculum at both the state and local level. This document provided the foundation and established the guidelines for what each person should know and be able to do in order to be technologically literate, and has been a primary tool in updating the *New Hampshire Technology Education Curriculum Guide.*

Career and Technical Education
Career and Technical Education has evolved from Vocational/Industrial Education as a result of development of a clustered approach by the US Department of Education in response to the changing nature of careers and work. It is realized that the nature of employment and work requires individuals who demonstrate an ability to learn and change as the nature of industry and business changes. The US Department of Education has developed a set of clusters which encompass the existing vocational program areas and allow for the changes reflected in the workplace. These clusters are characterized by secondary and post secondary education programs and contain linkages between these levels. Along with the development of the clustered approach to developing career readiness in learners, is an emphasis on

accountability based on student achievement of identified competencies for performance in the workplace. Competencies form the basis for one measure of student achievement at all levels of Career and Technical Education. As workplaces change and requirements for workers and processes change, the required competencies for graduates of programs change also. Some of these changes are reflected by industry based standards, certifications and licenses. Requirements for these standards and credentials are reflected in the competencies for programs and as the requirements change, program competencies change also. The clustered areas are seen to be flexible enough to allow some programs to change into new and emerging areas while some programs are diminished or phased out due to a lack of demand or enrollment. Additional information about all aspects of industry is provided to the learner and is inclusive of activities within the cluster. This provides some direction for continued learning and possible advancement for the learner.

Engineering

The evolution of Technology Education resulted in teachers using the Engineering Design Process to teach about technology. Students are taught to invent, innovate, design, test, model, evaluate, build and sometimes market solutions to simple and complex problems. Many New Hampshire Technology Education teachers continue to use engineering as a methodology to teach about technology and, as engineering programs become more popular, many teachers are teaching Engineering Concepts as a separate Content Area. There are three Engineering Programs that are popular among NH teachers; Project Lead the Way® (PLTW®), Engineering byDesign ™ (EbD ™) and Engineering is Elementary. The Center to Advance the Teaching of Technology and Science has described Engineering Programs as teaching the big "E" in Engineering or the little "e" in engineering. Programs teaching the big "E" help to prepare students to enroll in engineering programs at the college and university level. Programs teaching the little "e," prepare students to think like engineers and exposes them to a variety of technical careers. The Terminology Section of this Guide describes these programs in greater detail.

At the direction of the State Department of Education, and working under the supervision of the Pre-Engineering Technology Advisory Council (PETAC) and the Capital Area Center for Educational Support (CACES), a group of engineering teachers defined specific competencies that all New Hampshire engineering students should strive to achieve. The NH Engineering Competencies are related to the Technology/Engineering Education Competencies found in the Addendum to this Guide. The NHTEA recommends to those teachers wishing to teach engineering as a separate content area to use the NH Engineering Competencies that can be found on the Engineering NH web site at www.preengineeringNH.org .

Technology/Engineering Education:

Rationale

As technological development continues at an accelerating rate, it becomes increasingly difficult for people to understand the changes they experience in their society. Individuals can best enjoy the benefits of technology when they understand the problems inherent in it and are able to control and maintain it. Effective democracy depends on the participation of its citizens in the decision-making process. Because so many political and economic decisions involve technological issues, all citizens should achieve some level of technological literacy.

Technology/Engineering Education prepares individuals to participate and adapt to a changing society. For this reason, Technology/Engineering Education must be included as an integral part of the general education of every student in New Hampshire. To develop into a technologically literate individual, every student should experience a wide variety of technological activities with real world contexts and become exposed to the widest possible range of technological careers.

Technology/Engineering Education:

Mission

It is the mission of Technology/Engineering Education to advance technological literacy.

The mission of Technology/Engineering Educators, therefore, is to:

1. Interpret technology- its past, present, and future.
2. Organize and facilitate learning activities that are age-appropriate, action-oriented, and thematically related to different technological systems such as medical, agricultural & biotechnology, energy and power, information and communications, transportation, manufacturing, and construction technological systems.
3. Demonstrate how other disciplines such as math, science and the humanities relate to and integrate with technology.
4. Assess the impacts of technology on society in general and on individuals in particular.

Technology: Human innovation in action.

While other creatures have been known to make use of simple tools, the development of complex technological systems is a uniquely human activity. One of the primary qualities of this activity is change. Due to their limited physical capabilities, humans rely on technology to meet challenges in their environment. Quite often these challenges are met by making changes in their world. These changes lead to further challenges, and the cycle of technological development continues, not simply as a conceptual exercise, but as an ongoing creative activity.

Defined as such, technology extends beyond the observation and conceptualization of natural phenomena, the domain of science. It is also more than just a collection of artifacts, hardware cannot define a discipline. Technology is an activity that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities.

Technological Literacy: The ability to use, manage, understand, and assess technology.

Over a short period of time a large gap has developed between the knowledge, capability, and confidence of consumers and that of the inventors, researchers, and implementers who work to develop the technological world in which we live. Thus, all citizens need to become technologically literate in order to be productive users of technology. It is very important to understand technology in a broad spectrum, but it also involves the ability to synthesize the information into new insights. Understanding technology requires examination of solutions, *and of* their design, evolution, and impact on human existence.

Technology/Engineering Education: The discipline devoted to the study of technology, providing an opportunity for students to learn about the processes and knowledge related to technology that are needed to solve problems and extend human capabilities.

Due to the need for all people to become technologically literate, the need for Technology/Engineering Education is increased. Technology/Engineering Education is education about all of technology; its processes, evolution, systems, resources, limitations, impacts, products, and problems. It examines technology in its historical, environmental, economic, ethical and cultural contexts. Through the problem-solving processes, students learn to research, study, create, and evaluate. Technology/Engineering Education is an action-based discipline devoted to the application of human ingenuity and innovation. As a result of Technology/Engineering Education, students will better understand the world in which they live and be more prepared for the future.

PETAC: Pre-Engineering Technology Advisory Council

PETAC was established by the New Hampshire Legislature and consists of representatives from the Legislature, Education, Industry and the Public. (Chapter 188-E: 16) PETAC's role is to advise the Department of Education in the implementation and expansion of pre-engineering technology curriculum used in the New Hampshire's public schools. It is also to assist the Department of Education in pursuing public and private funds in order to ensure statewide access for all public high school students to pre-engineering technology curriculum coursework.

Engineering: Using a knowledge of math and science to design, create, and enhance technology.

Engineering involves the art and science of planning, constructing, operating, and managing technological systems for the benefit of humanity. The exponential increase in human knowledge and understanding of both natural and technological systems, and the interaction of these, requires the commitment of resources to ensure citizens are prepared to make ethical and practical decisions based upon real understanding of complex interactions.
(The terms engineering and pre-engineering are used interchangeably by educators throughout New Hampshire to describe courses that use the engineering design process to teach engineering concepts and principles.)

PLTW®: Project Lead The Way®

Project Lead The Way® (PLTW®) is a not-for-profit organization that promotes pre-engineering courses for middle and high school students. PLTW® forms partnerships with public schools, higher education institutions and the private sector to increase the quantity and quality of engineers and engineering technologists graduating from our educational system.

EbD™: Engineering byDesign™

The Engineering byDesign ™ (EbD™) Program is a model used by schools developing themes in the Science, Technology, Engineering, Mathematics (STEM) and other Career Clusters that are seeking to increase all students' achievement in technology, science, mathematics, and English through authentic learning. The program is built on specific models and creates awareness and competence over time as it builds on learned knowledge and skills—aligning closely with the Cluster Knowledge and Skills in all Career Clusters. EbD ™ provides a broad standards-based K-12 program that ensures that all students are technologically literate, as well as providing clear standards and expectations for increasing student achievement in math, science, and technology.

Engineering is Elementary

The *Engineering is Elementary* (EiE) project aims to foster engineering and technological literacy among children. EiE is creating a research-driven, standards-based, and classroom-tested curriculum that integrates engineering and technology concepts and skills with elementary science topics. EiE lessons not only promote K-12 science, technology, engineering, and mathematics (STEM) learning, but also connect with literacy and social studies. Engineering is Elementary is a product of the Boston Museum of Science. (Accessed from www.mos.org/eie, on November 20, 2008)

Technology/Engineering Education:

Goals

Technology/Engineering Education will contribute to the development of all students by:

A. Providing opportunities to develop safe and appropriate skills and awareness in a wide range of traditional and contemporary technologies.

B. Providing opportunities to plan, develop, operate, control, and maintain a variety of technological systems such as medical, agricultural, biological, energy and power, information and communication, transportation, manufacturing, construction, and engineering.

C. Preparing students to recognize, use and prepare technical information in order to engineer solutions to problems related to a variety of technological systems.

D. Encouraging those habits of mind necessary to a lifelong learner such as the ability to question, investigate, design, experiment, and evaluate.

E. Promoting an appreciation for the interdependency of technology and other disciplines.

F. Increasing understanding of the relationships between technology, individuals, and society.

G. Providing an introduction to the impact technology has on society and the environment.

H. Encourage the development of leadership abilities through participation in extracurricular activities such as the Technology Student Association and projects that support their communities.

Methodological Assumptions

Classroom/laboratory experiences will be designed utilizing the following approaches:

1. Emphasis will be placed on the hands-on solution of problem-solving challenges as a principal delivery method.
2. Activities will be laboratory-based and action-oriented.
3. Emphasis must be placed on the safe and proper application of the techniques, equipment, and materials in the labs.
4. Labs should be designed to encourage safe placement and use of equipment and storage of materials.
5. Class size should support the supervision and safety of students as well as the safe and proper use of the labs and their equipment.
6. Cooperative learning and small group interaction, and design teams will be encouraged.
7. Exploratory activities will include real and simulated situations.
8. A broad range of assessment strategies (design portfolios, project work, individual and group work, presentations, performance testing, etc.) will be utilized in the evaluation process.
9. Emphasis will be placed on activities that explore the relationship between different technologies and disciplines and society.
10. The engineering design process will be implemented to encourage engineering thinking.

Technology/Engineering Education:

Content Assumptions

The program/course content for Technology/Engineering Education should be based on:

1. An organized set of concepts, processes, and systems that is unique to the study of technology.

2. Fundamental knowledge about the historical development of technology and its effects on people, the environment, and society.

3. Contemporary instructional content, drawn from one or more of the following technological systems (in order from the national standards):
   - Medical Technologies
   - Agricultural, and related Biotechnologies
   - Energy and Power Technologies
   - Information and Communications Technologies
   - Transportation Technologies
   - Manufacturing Technologies
   - Construction Technologies
   - Engineering Principles and Design

4. Development of insight, understanding, and application of technological concepts, processes, and systems to engineer solutions to future problems and needs.

5. Safe and efficient application of tools, materials, machines, processes, and technical concepts.

6. Development of students' skills, creative abilities, positive self-concepts, and individual potential in engineering and technology.

7. Development of students' problem-solving and decision-making abilities involving human and material resources, processes, and technological systems.

8. Activity-oriented laboratory instruction with students, reinforcing abstract concepts and engineering skills with concrete experiences.

9. Preparation of students for lifelong learning in a technological society.

Technology Competencies

The following competencies are applied to each content area and grade level, listed in the guide. (medical, agricultural, biological, energy and power, information and communication, transportation, manufacturing and construction) These competencies and how they apply to each Content Area may be found in the addendum to the NHTEA Curriculum Guide. Engineering Competencies may be found on the Engineering NH web site at www.preengineeringnh.org .

1. Students will understand that the study of technology involves an organized set of concepts, processes, and systems that are specific to the study of technology.

2. Students will understand that the implementation of technological solutions requires the application of human and material resources, processes, and systems.

3. Students will understand that technological systems require input, processes, output, and feedback.

4. Students will understand that relationships exist among technologies and between technology and other fields of study.

5. Students will understand that there are interrelationships among the individual, society, technology, and the environment.

6. Students will understand that solving problems relating to a variety of technological systems requires the use of technical information.

7. Students will understand that they must develop the ability to question, investigate, experiment, and evaluate; habits of mind necessary to a lifelong learner.

8. Students will understand that solving technological problems involves cooperation, collaboration, and individual contributions.

9. Students will understand that technological problem solving requires the application of the design process.

10. Students will understand that all technological systems require the development of safe and acceptable applications of techniques, equipment, and materials.

11. Students will understand that safe practices, attitudes, and awareness are essential within all areas and levels of technologies.

12. Students will understand that there is a need for human societies to develop, control, and maintain a variety of technological systems such as medical, agricultural, biological, energy and power, information and communication, transportation, manufacturing and construction.

13. Students will understand that it is important to develop leadership abilities through participation in co-curricular activities such as the Technology Student Association and projects that support their communities.

Technology/Engineering Content Areas

Medical Technology is the application of specialized equipment in the diagnosis, treatment, and prevention of disease. Understanding of the physical and biological ('hard' science) components must be matched with an appreciation for the social aspects of disease and treatment. Because issues connected with the application of many medical technologies can lead to ethical conflict, the need for comprehensive understanding based on accurate information is critical. As dialogue and demand increase regarding access to health care in national and global platforms, developments in medical technology are occupying a larger share of political attention. Only through knowledgeable discourse, continuing innovation, and accurate, compassionate application of medical technologies can sound decisions and advancements be made for a healthy future society, as well as for individuals in the present.

Agricultural Technologies and related Biotechnologies deal with the application of knowledge, techniques, and resources to the raising of crops and animals for food, feed, fiber, fuel, and other useful products. Biotechnology, which uses part or whole living organisms to create or modify products, improve plants or animals, or develop microorganisms for specific uses, has been applied in this endeavor throughout human history. A clear understanding is needed to be able to assess and manage the effects of agricultural, and biotechnologies used to create artificial ecosystems and genetically modified plants and animals in order to sustain the Earth's natural resources.

Energy and Power Technologies are concerned with the ability to use, manage, assess, and understand the generation, conversion, control, transmission, and storage of potential/kinetic energy, and the machines and tools used to increase strength and mechanical advantage. Technological products and systems need energy in order to work. Thus, the processing and controlling of energy resources have been key features in the development of technology. It is the responsibility of all citizens to conserve energy resources to ensure that future generations will have access to these natural resources. In order to decide what energy resources should be further developed, people must critically evaluate the positive and negative impacts of this area related to technology. Activities in this area should introduce all of the major scientific, mathematical, and ethical concepts related to energy and power technologies.

Information and Communication Technology is concerned with the ability to use, manage, assess, and understand the transfer of information from a sender to a receiver. Information and communication technologies date from the development of human speech and language, and continue through the creation of a variety of writing and encoding systems and the invention of printing. Now they also include computers and related devices, an increase in the number of available sensory media, electronic transmitters and receiving devices, and entertainment products. Digital technologies have revolutionized society's information handling capacity to the point that the Industrial Revolution has evolved into the Information Age.

Transportation Technologies are concerned with the ability to use, manage, assess, and understand the complex network of interconnected components that operate on land, on water, in the air, and in space to move humans or resources from one location to another. As life and work become more complex, transportation systems become more indispensable to the smooth workings of society. Because transportation has become such an integral part of life, people often take it for granted or consider it an ordinary part of the world. People need to understand the various systems that are interconnected into this network so that they may understand the environmental, social, and economic issues related to this complex area of technology. Issues such as appropriate or alternative technologies, the effects of the development of individual versus mass transportation on urban development would all fall under this category. As we develop into further space exploration, we need to understand that transportation is no longer limited to our world but can be used as a tool to open up the worlds around us.

Manufacturing Technologies are concerned with the ability to use, manage, assess, and understand the processes used to turn raw materials into useful items. Emphasis is placed on 1) recognizing the differences in producing and using natural and synthetic materials, 2) understanding and using creative problem solving techniques to come up with design solutions, 3) designing and managing production systems, processes, and resources and 4) the ability to assess the functionality and marketability of the finished product. Skills developed in many manufacturing courses are often applied to professional or vocational pursuits. An understanding of Manufacturing Technologies will be vital in societies dealing with issues such as the development of a global economy, the relations between labor and capital, and the conservation of scarce resources.

Construction Technologies is the effective use of materials, labor, equipment, methods, and management resources to produce a self-supporting structure. These structures can be used as residences, office buildings, entertainment, storage, or commercial facilities. Structures can be part of transportation systems such as roads, bridges, or airports. Structures can be used for cultural, artistic or civic purposes, as pyramids, statues, or monuments. Structures can be as permanent as the pyramids or as temporary as scaffolding. While construction and manufacturing technologies are similar in that they both produce useful items, Construction is predominantly used for customized designs while manufacturing generally focuses on mass production techniques. Classes in Construction Technology should involve a variety of construction types. Emphasis should be placed on the understanding of processes used in planning for the design, building, use, and maintenance of different structures.

Engineering involves the art and science of planning, constructing, operating, and managing technological systems for the benefit of humanity. The exponential increase in human knowledge and understanding of both natural and technological systems, and the interaction of these, requires the commitment of resources to ensure citizens are prepared to make ethical and practical decisions based upon real understanding of complex interactions.

The first seven content areas are based on the Standards listed in “The Designed World” section of the *Standards for Technological Literacy: Content for the Study of Technology* as published by the International Technology Education Association. The order used in listing content areas in this document is consistent with those Standards and does not imply a priority of importance.

Program Descriptions and Outcomes

Technology/Engineering Education:

Elementary Level

Theme: **Exposure and Orientation to Technology**

Program Description:

Children at the Elementary Level (grades K-5) are active learners. Many of their play activities can be seen as investigations of the materials, systems, and techniques of technology available to them. They will observe, problem-solve, design, build, evaluate, and redesign while exploring a variety of natural and synthetic materials. These materials might include sand, clay, wood, plastics, paper, cardboard, even food. Their communication skills will continue to develop with exposure to a variety of media from paints, crayons, and colored pencils, to computers and digital media. Their interpersonal contacts will expand beyond the family into the larger community, exposing them to the skills needed when individuals work in groups as well as the many ways technology is used in society. This exposure may come through real-life activities such as visits to the neighborhood firehouse or evaluating the effectiveness of the design of their school. It could also come through teacher-developed problems, from evaluating materials-testing methods used by Goldilocks or the Three Pigs, to a mass production/packaging design/marketing unit.

Students at this level are encouraged to use the engineering design loop and a trial and error approach to solving problems. The Pre-Engineering Technology Advisory Council (PETAC) and the NH Department of Education recognizes The Engineering byDesign ™ Curriculum with its series of ten activities under the title, I^3: Invention, Innovation and Inquiry as exemplary Technology/Engineering curricula. The activities are based on the Standards for Technological Literacy compiled by the International Technology Education Association. The I^3 project was funded by the National Science Foundation.

Technology/Engineering Education should be included as a regularly scheduled part of the general Elementary Level curriculum. Equipment and material requirements beyond basic grade-level classroom supplies are minimal. Technology/Engineering Education can be taught in a regular classroom by a qualified Elementary teacher. Appropriate in-service training should be made available for teachers inexperienced in Technology/Engineering Education. Ideally, Technology/Engineering Education should be part of the undergraduate degree requirements at institutions that prepare Elementary teachers.

Technology/Engineering Education:

Student Performance Outcomes: K-2

These student performance outcomes relate to the corresponding letter goal found on page fourteen.

The student will be able to:

- A1. Identify various forms and systems of measurement.
- A2. State and practice safety rules related to technology activities.
- A3. Safely use hand tools in a technological setting.
- A4. Identify technological activities in different occupations.
- B1. Define technology and identify that technological systems are made up of subsystems and components.
- B2. Practice basic design principles and processes.
- B3. Use a variety of materials in activities.
- C1. Identify that the collection and organization of information and data is a key component of technological activities.
- C2. Use appropriate terminology in a variety of technical environments.
- D1. Use problem-solving strategies in a technological setting.
- E1. List examples of technology in the classroom and at home.
- F1. Describe the historical evolution of technological inventions.
- G1. Identify ways technology is helpful or harmful to the natural world.
- G2. Identify ways people have adapted the natural world to meet their needs and wants.
- H1. Identify how technological resources are used in the local community.

Technology/Engineering Education:

Student Performance Outcomes: 3-5

These student performance outcomes relate to the corresponding letter goal found on page fourteen.

The student will be able to:

- A1. Identify and accurately use English and metric units of measure.
- A2. State and practice safety rules related to technology activities.
- A3. Safely use hand tools and appropriate power tools under supervision, in a technological setting.
- A4. Identify and describe technological activities related to careers and occupations.
- B1. Define technology and identify components and subsystems that make up technological systems and associated industries.
- B2. Practice design principles and processes in basic technological activities.
- B3. Identify and utilize a variety of materials in activities.
- C1. Use information and data in the design process.
- C2. Use technical terminology used in a technical environment.
- D1. Demonstrate appropriate problem-solving strategies and techniques for solving technical problems.
- E1. List examples of technology in the classroom, at home, and at the parents' workplaces.
- F1. Describe the historical evolution of technological inventions as societies needs and wants change.
- G1. Discuss ways technology is helpful or harmful to the natural world.
- G2. Identify ways people have adapted the natural world to meet their needs and wants or to solve problems.
- H1. Identify how technological resources benefit the local community.

Middle Level

Theme: **Exploration of Technology**

Program Description:

Students in the Middle Level (grades 6-8) display a wide variety in development of interpersonal skills due to the rapid changes of adolescence. Students at this stage are intensely involved in grasping their own identities and their place in the community and society. Technology/Engineering Education at this level should respond to the distinct developmental needs of these students as it helps them explore and expand their understanding of technology. Technology/Engineering Education should take advantage of adolescent perspective and provide opportunities for them to develop their ability to design, develop, use, and create technological products, processes, and systems with connections to community and culture. Activities should be designed to help students recognize the relationship between theory and application. Students will continue to investigate personal skills and interests within the technological context; at the same time they will learn basic principles of engineering, architecture, industrial design, and computer science. They should be challenged to apply and integrate knowledge and skills learned in other classes, both in the technology lab as well as in extracurricular activities. Real and simulated activities should be used that require students to learn and apply problem-solving skills, creative techniques, and teamwork. Students will develop their ability to access, manipulate, use, and communicate technical information. Students should become more aware of the developmental nature of technology and its effects on individuals, society and the natural world.

Technology/Engineering Education at this level should be integrated as a core part of the curriculum for all students. It can be taught by a certified individual or by an interdisciplinary team that includes a certified Technology/Engineering Education teacher. Schools may be designed with multiple labs dedicated to one or more technological contexts, or general-use labs. Facilities should be designed for the safe and effective use of the tools, equipment, materials, processes, and techniques within the context of the designed world, including activities in each of the Technology Content Areas (see pp. 19 - 20).

Technology/Engineering Education at the middle school level strives to provide students with literacy about technology and the fields of engineering. Two engineering curricula at this level have been recognized by the Pre-Engineering Technology Advisory Council (PETAC) and the NH Department of Education: Engineering byDesign™ (EbD™) and Gateway to Engineering/Project Lead the Way® (PLTW®). All EbD™ and PLTW® courses at this level provide students with an awareness and exploratory activities which may form a basis for future courses in engineering and/or technology.

Technology/Engineering Education:

Student Performance Outcomes: 6-8

These student performance outcomes relate to the corresponding letter goal found on page fourteen.

The student will be able to:

- A1. Demonstrate the accurate use of appropriate measuring tools to gather, manipulate, and communicate information.
- A2. Demonstrate safe working attitudes and practices.
- A3.Demonstrate basic skills in the safe and proper selection and use of technical equipment, materials, and processes.
- A4. Identify basic skills required in technological careers.
- B1. Recognize the core concepts of a "technological system" which include input, processes, output, and feedback.
- B2. Identify and investigate various types of technology systems (including: medical, agricultural, biological, energy and power, information and communication, transportation, manufacturing, construction and engineering).
- C1. Demonstrate skills needed to find, use, and communicate technical information.
- D1. Apply problem-solving techniques to technological challenges involving materials, processes, and products.
- E1. Apply academic concepts and practices in a technological setting.
- F1. Trace the evolution of technological systems and processes.
- G1. Evaluate technological systems and their impact on people, the environment, culture, and the economy.
- H1. Exhibit responsible individual and cooperative work habits.

Secondary Level

Theme: **Evaluation and Implementation of Technology**

Program Description:

Students at the Secondary Level (grades 9-12) are continuing the process of self-definition begun in the Middle Level Grades. As students mature, they are asked to take more responsibility for their own learning and are faced with making decisions about their interests, skills, education, and work that will have a definitive influence on their lives. Technology/Engineering Education should inform their decision-making process and provide a firm foundation for lifelong learning about technology.

Technology/Engineering Education courses must prepare students to be technologically literate. They should help students develop individual interests and skills in technology. These courses should also deepen their understanding of the relationship between technology and other disciplines. Students should be prepared by these classes to further their education in technological careers in fields such as engineering, architecture, construction, computer science, or Technology/Engineering Education. Technology/Engineering Education courses should enhance the student's ability to evaluate technology's effect on individuals, society, and the natural world. They should be able to apply knowledge of materials and processes to analyze, design, create, manage, and evaluate technological products or systems. Students should also be able to use problem-solving techniques to extend human capabilities.

Technology/Engineering Education at the Secondary Level must support a diverse program able to build on Middle Level experiences in medical, agricultural, biological, energy and power, information and communication, transportation, manufacturing and construction. Students should be able to choose from a sequence of courses that will allow them to develop their skills, interests, and knowledge in any of these particular technological contexts. Technology/Engineering Education must be offered in dedicated labs designed to allow students to safely and effectively work with appropriate tools, equipment, materials, and processes. Technology/Engineering Education classes should be taught by a certified teacher, either individually or in a team-teaching environment.

Technology/Engineering Education at the high school level has two goals: first, it strives to provide students with literacy about technology and the fields of engineering; second, it strives to prepare students to continue their technical education after high school. Two engineering curricula at this level have been recognized by the Pre-Engineering Technology Advisory Council (PETAC) and the NH Department of Education: Engineering byDesign™ (EbD™,) and Project Lead the Way® (PLTW®). The first 3 EbD™ courses at this level (grades 9 – 10) tend to be introductory, teaching technological literacy. The following three courses are more advanced with the goal of preparing students to continue their technical education at the post secondary level. All PLTW® courses have the goal of preparing students to continue their engineering education at the post secondary level.

Technology/Engineering Education:

Student Performance Outcomes: 9-12

These student performance outcomes relate to the corresponding letter goal found on page fourteen.

The student will be able to:

- A1. Select and use appropriate measuring tools to accurately gather, manipulate, and communicate information.
- A2. Exhibit the safe and proper selection, use and maintenance of technical equipment, materials, and processes.
- A3. Discover and develop talents, aptitudes, and interests of the individual related to technical pursuits.
- A4. Demonstrate an awareness of career opportunities and requirements needed to make informed and meaningful choices in their education/employment in technical occupations.
- B1. Design, schedule, manage, and assess technical processes and systems.
- C1. Demonstrate those technical skills needed to find, use and communicate information effectively in a technological world.
- D1. Design, develop, manage, and evaluate activities using identified problem-solving techniques.
- E1. Exhibit an understanding of the relationship between academic concepts and practices to their applications in a technological setting.
- F1. Evaluate the effects of technology's development on society through time.
- F2. Evaluate examples of how technological systems and processes have developed to satisfy human needs and wants.
- G1. Describe technology's impact on society and the environment, and its capacity to enhance or destroy the human condition and quality of life.
- H1. Demonstrate an understanding of and an appreciation for the importance of accepting individual responsibility, developing a solid work ethic and learning to plan and work effectively.

Technology/Engineering Education Standards Checklist

This checklist is provided as a means to evaluate the strengths and weaknesses of a program. It is to be used by schools as a method to plan and improve their program of study in Technology/Engineering Education

Philosophy:

A current, comprehensive, written philosophical statement is available, and it influences thought and action for Technology Education.

Yes	No	
Development		
		1. The statement was developed as a joint effort, with input from teachers, administrators, students, parents, community representatives, and other appropriate consultants.
		2. The statement is consistent with local, state, and national philosophies of education and of Technology Education.
		3. The statement supports the existence of the program.
Utilization		
		4. The statement is used as a basis for program planning, development, implementation, and evaluation.
Revision		
		5. The statement is reviewed and revised at least once every five years.

Instructional Program:

The instructional program reflects the stated Technology Education philosophy through experiences designed to meet the needs of all students.

Goals		
		6. Program goals articulate the mission of Technology Education.
		7. Goals are consistent with local, state, and national standards and emerging developments in the field.
		8. Goals are developed with input from teachers, administrators, and others.
		9. Goals are written and kept on file with the school's administration.
		10. Goals are utilized by teachers and administrators for planning, implementing, and evaluating curriculum.

Objectives		
		11. Written, measurable objectives are shared with students and parents and kept on file with the school's administration.
		12. Objectives are used by teachers and administrators for planning, implementing, and evaluating course content and instructional methods.
		13. Objectives are used as a basis for developing the Technology Education component of the Individualized Education Program (IEP).
Content		
		14. Course content is developed from course objectives and uses approved curriculum guides, and other professional resources.
		15. Content is offered in Medical Technology.
		16. Content is offered in Agricultural Technology and Biotechnology.
		17. Content is offered in Energy and Power Technology.
		18. Content is offered in Information and Communication Technology.
		19. Content is offered in Transportation Technology.
		20. Content is offered in Manufacturing Technology.
		21. Content is offered in Construction Technology.
		22. Course content is selected to provide for all students.
		23. Content includes the development of personal and leadership skills through student organizations such as the Technology Student Association.
		24. Courses are sequential (K-12), beginning with broad orientations and exploration of subject matter followed by specialized experiences.
		25. Course content reflects current topics and trends in industry and technology.
		26. Content is organized into outlines, unit plans, and lesson plans.
		27. A written description for each course is available to all students prior to enrollment.
		28. Course content is reviewed annually and revised at least once every five years.
		29. Technology Education courses are of sufficient duration to achieve program objectives.
		30. Students are encouraged to enroll in courses from more than one content area during their total Technology Education experience.
Facilities		
		31. Facilities are within the size guidelines recommended by the state in Ed 321.10 – h, i, k; Ed 321.19 - i *(see Appendix C)*
		32. Facilities are designed to support safely the content for which they are used.
Faculty		
		33. All courses are taught by faculty certified in Technology Education.
Student Population		
		34. All students, regardless of their race, color, religion, marital status, national/ethnic origin, age, sex, sexual orientation, or disability are admitted to and served by Technology Education courses.

Appendix A: Comparing ITEA Standards to NH Technology/Engineering Education Program Objectives

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
1. Students will develop an understanding of the characteristics and scope of technology.							
1a. The natural world and human-made world are different.	B3, G1, G2	1c. Things that are found in nature differ from things that are human-made in how they are produced.	B3, G2	1f. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.	A3, A4, B2, C1, D1, F1, G1,	1j. The name and development of technological knowledge and processes are functions of the setting.	A2, A3
1b. All people use tools and techniques to help them do things.	A3, A4, E1, F1, G1, G2, H1	1d. Tools, materials, and skills are used to make things and carry out tasks.	B1, B2, E1, G2	1g. The development of technology is a human activity and is the result of individual or collective needs and the ability to be creative.	A4, D1, F1, G1, H1	1k. The rate of technological development and diffusion is increasing rapidly.	A3, A4, B1
		1e. Creative thinking and economic and cultural influences shape technological development.	F1, G1	1h. Technology is closely linked to creativity, which has resulted in innovation.	A4, D1, E1, F1	1l. Inventions and innovations are the results of specific, goal-directed research.	B1, E1
				1i. Corporations can often create demand for a product by bringing it onto the market place and advertising it.	A4, C1, D1, F1, G1	1m. Most development of technologies these days is driven by the profit motive and the market.	A4

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
2. Students will develop an understanding of the core concepts of technology.							
2a. Some systems are found in nature, and some are made by humans.	A1, B1	2a. A subsystem is a system that operates as a part of another system.	B1	2m. Technological systems include input, processes, output, and, at times, feedback.	B1	2w. Systems thinking applies logic and creativity with appropriate compromises in complex real-life problems.	D1
2b. Systems have parts or components that work together to accomplish a goal.	B1	2b. When parts of a system are missing, it may not work as planned.	B1	2n. Systems thinking involves considering how every part relates to others.	A2, B1, C1, D1, E1	2x. Systems, which are the building blocks of technology, are embedded within larger technological, social, and environmental systems.	B1, C1, D1
2c. Tools are simple objects that help humans complete tasks.	A1, A3	2c. Resources are the things needed to get a job done, such as tools and machines, materials, information, energy, people, capital, and time.	A3, B2, B3, D1, H1	2o. An open-loop system has no feedback path and requires human intervention, while a closed-loop system uses feedback.	A2, B1, C1, D1	2y. The stability of a technological system is influenced by all of the components in the system, especially those in the feedback loop.	B1, C1, D1
2d. Different materials are used in making things.	B3	2d. Tools are used to design, make, use, and assess technology.	A1, A2, A3, D1, H1	2p. Technological systems can be connected to one another.	B1, E1	2z. Selecting resources involves trade-offs between competing values, such as availability, cost, desirability, and waste.	A1, A2, B1, C1, D1,
2e. People plan in order to get things done.	B2, C1, D1	2e. Materials have many different properties.	B3	2q. Malfunctions of any part of a system may affect the function and quality of the system.	A2, B1, C1, D1, E1,	2aa. Requirements involve the identification of the criteria and constants of a product or system and the determination of how they affect the final design and development.	A1, C1, D1, E1

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
		2f. Tools and machines extend human capabilities, such as holding, lifting, carrying, fastening, separating, and computing.	A1, A2, A3, D1, F1, G1	2r. Requirements are the parameters placed on the development of a product or system.	A2, A4, D1	2bb. Optimization is an ongoing process or methodology of designing or making a product and is dependent on criteria and constraints.	C1, D1, E1
		2g. Requirements are the limits to designing or making a product or system.	B2, D1	2s. Trade-off is a decision process recognizing the need for careful compromises among competing factors.	A2, D1	2cc. New technologies create new processes.	B1, C1, D1,
				2t. Different technologies involve different sets of processes.	B1, C1, D1	2dd. Quality control is a planned process to ensure that a product, service, or system meets established criteria.	C1, D1, H1
				2u. Maintenance is the process of inspecting and servicing a product or system on a regular basis in order for it to continue functioning properly, to extend its life, or to upgrade its capability.	B1, D1	2ee. Management is the process of planning, organizing, and controlling work.	A3, H1,
				2v. Controls are mechanisms or particular steps that people perform using information about the system that causes systems to change.	A2, C1, D1, G1	2ff. Complex systems have many layers of controls and feedback loops to provide information.	A1, D1,

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
3. Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.							
3a. The study of technology uses many of the same ideas and skills as other subjects.	D1, E1	3d. Technological systems often interact with one another.	A3, A4, B1, B2, B3, D1, E1, F1, G1, H1	3d. Technological systems often interact with one another.	E1	3g. Technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function.	B1, C1, D1
3b. Technologies are often combined.	A3, A4, B1, B2, B3, D1, E1, F1, G1, H1	3e. A product, system, or environment developed for one setting may be applied to another setting.	A1, A2, A3, A4, B1, B2, B3, C2, D1, E1, F1,G1, H1	3e. A product, system, or environment developed for one setting may be applied to another setting.	A3, A4, E1, F1	3h. Technological innovation often results when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.	A4, B1, C1, D1, E1
3c. Various relationships exist between technology and other fields of study.	A1, A2, A3, A4, B1, B2, B3, C2, D1, E1, F1, G1, H1	3f. Knowledge gained from other fields of study has a direct effect on the development of technological products and systems.	A1, C1, C2, E1, H1	3f. Knowledge gained from other fields of study has a direct effect on the development of technological products and systems.	A1, A4, E1, F1	3i. Technological ideas are sometimes protected through the process of patenting.	C1, D1, H1,
						3j. Technological progress promotes the advancement of science and mathematics.	E1

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
4. Students will develop an understanding of the cultural, social, economic, and political effects of technology.							
4a. The use of tools and machines can be helpful or harmful.	D1, G1	4b. When using technology, results can be good or bad.	G1, G2	4d. The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use.	A2, C1, D1, E1, F1	4h. Changes caused by the use of technology can range from gradual to rapid and from subtle to obvious.	A4
		4c. The use of technology can have unintended consequences.	F1, G1, G2	4e. Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences.	A2, C1, D1, E1, F1	4i. Making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.	B1, D1
		4d. The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use.	A4, E1, F1, G1, G2, H1	4f. The development and use of technology poses ethical issues.	A4, C1, D1, E1, G1	4j. Ethical considerations are important in the development, selection, and use of technologies.	A1, A2, H1,
		4e. Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences.	B1, E1, F1, G1,	4g. Economic, political, and cultural issues are influenced by the development and use of technology.	A4, B2, C1, D1, E1, G1	4k. The transfer of a technology from one society to another can cause cultural, social, economic, and political changes affecting both societies to varying degrees.	F2, H1,
		4f. The development and use of technology poses ethical issues.	E1, F1, G1				
		4g. Economic, political, and cultural issues are influenced by the development and use of technology.	E1, F1, G1, G2				

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
5. Students will develop an understanding of the effects of technology on the environment.							
5a. Some materials can be reused and/or recycled.	A4, B1, B2, B3, E1, F1, G1, H1	5b. Waste must be appropriately recycled or disposed of to prevent unnecessary harm to the environment.	A1, A2, A4, B3, F1, G1, H1	5d. The management of waste produced by technological systems is an important social issue.	A2, C1 D1, E1, G1	5g. Humans can devise technologies to conserve water, soil, and energy through such techniques as reusing, reducing, and recycling.	A1, A2, D1, E1, H1
		5c. The use of technology affects the environment in good and bad ways.	F1, G1	5e. Technologies can be used to repair damage caused by natural disasters and to break down waste from the use of various products and systems.	E1, G1	5h. When new technologies are developed to reduce the use of resources, considerations of trade-offs are important.	A1, F2, H1
				5f. Decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another.	A2, A4, E1, G1	5i. With the aid of technology, various aspects of the environment can be monitored to provide information for decision-making.	A1, B1, C1, D1
						5j. The alignment of technological processes maximizes performance and reduces negative impacts on the environment.	A1, A2, C1, D1, E1
						5k. Humans devise technologies to reduce the negative consequences of other technologies.	A1, C1, D1, F1, H1,
						5l. Decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment.	A1, D1, F1, F2, H1

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
6. Students will develop an understanding of the role of society in the development and use of technology.							
6a. Products are made to meet individual needs or wants.	A1, B2, B3, D1, E1, F1, G1	6b. Because people's needs and wants change, new technologies are developed and old ones are improved to meet those changes.	A4, B1, D1, F1, G1, G2	6d. Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies.	A2, A4, C1, D1, E1, F1, G1	6h. Different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.	C1, D1, F2
		6c. Individual, family, community, and economic concerns may expand or limit the development of technologies.	B1, E1, F1, G1	6e. The use of inventions and innovations has led to change in society and the creation of new needs and wants.	A4, E1, F1, G1	6i. The decision to develop a technology is influenced by societal options and demands in addition to corporate cultures.	A2
				6f. Social and cultural priorities and values are reflected in technological devices.	A2, E1, G1	6j. A number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads contribute to shaping the design of and demand for various technologies.	A1, A3, B1, C1, D1, E1, F2
				6g. Meeting societal expectations is the driving force behind the acceptance and use of products and systems.	A2, E1, F1, G1		

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
7.Students will develop an understanding of the influence of technology on history.							
7a. The way people live and work has changed throughout history because of technology.	A4, B1, E1, F1, G1	7b. People have made tools to provide food, to make clothing, and to protect themselves.	A4, B1, E1, F1, G1, G2	7c. Many inventions and innovations have evolved by using slow and methodical processes of tests and refinements.	A2, A3, A4, B1, D1, E1, F1	7g. Most technological development has been evolutionary, the result of a series of refinements to a basic invention.	B1, G1,
				7d. The specialization of function has been at the heart of many technological improvements.	A4, E1, F1, H1	7h. The evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.	A2, G1,
				7e. The design and construction of structures for service or convenience have evolved from the development of techniques for measurement, controlling systems, and the understanding of spatial relationships.	A1, A4, D1, E1, F1, G1	7i. Throughout history, technology has been a powerful force in reshaping the social, cultural, political, and economic landscape.	F2, G1,
				7f. In the past, an invention or innovation was not usually developed with the knowledge of science.	A2, C1, D1, E1, F1	7j. Early in the history of technology, the development of many tools and machines was based not on scientific knowledge but on technological know-how.	E1, F1, F2, G1,

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						7k. The Iron Age was defined by the use of iron and steel as the primary materials for tools.	F1, F2, G1,
						7l. The Middle Ages saw the development of many technological devices that produced long-lasting effects on technology and society.	F1, F2, G1,
						7m. The Renaissance, a time of rebirth of the arts and humanities, was also an important development in the history of technology.	F1, F2, G1,
						7n. The Industrial Revolution saw the development of continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.	F1, F2, G1,
						7o. The Information Age places emphasis on the processing and exchange of information.	F1, F2, G1,

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8. Students will develop an understanding of the attributes of design.							
8a. Everyone can design solutions to a problem.	A2, A3, B2, B3, C2, D1, H1	8c. The design process is a purposeful method of planning practical solutions to problems.	B2, D1, F1	8e. Design is a creative planning process that leads to useful products and systems.	A4, B1, D1, E1	8h. The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.	A1, A2, B1, D1
8b. Design is a creative process.	B2, D1, F1	8d. Requirements for a design include such factors as the desired elements and features of a product or system, or the limits that are placed on the design.	A1, B1, B2, D1, G1, H1	8f. There is no perfect design.	B1, D1	8i. Design problems are seldom presented in a clearly defined form.	B1, D1
				8g. Requirements for a design are made up of criteria and constraints.	A1, B1, D1	8j. The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved.	A1, B1, D1, E1, F1, F2
						8k. Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other.	A1, B1, D1, E1,

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
9. Students will develop an understanding of engineering design.							
9a. The engineering design process includes identifying a problem, looking for ideas, developing solutions, and sharing solutions with others.	A1, A2, A3, B1, B2, B3, C2, D1, E1, F1, G1, H1	9c. The engineering design process involves defining a problem, generating ideas, selecting a solution(s), testing the solution(s), making the item, evaluating it, and presenting the results.	A1, C1, C2, E1, H1	9f. Design involves a set of steps, which can be performed in different sequences and repeated as needed.	B1, D1	9i. Established design principles are used to evaluate existing designs, to collect data, and to guide the design process.	A1, A3, D1, E1
		9e. Models are used to communicate and test design ideas and processes.	F1	9h. Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.	A1, A2, A4, B1, C1, D1, E1,	9k. A prototype is a working model used to test design concepts by making actual observations and necessary adjustments.	A1, B1, D1
						9l. The process of engineering design takes into account a number of factors.	A3, H1

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
10. Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.							
10a. Asking questions and making observations helps a person figure out how things work.	A4, B1, B2, B3, D1, E1, F1, G1, H1	10c. Troubleshooting is a way of finding out why something does not work so that it can be fixed.	B2, D1, G1, G2	10f. Troubleshooting is a problem-solving method used to identify the cause of malfunction in a technological system.	A1, B1, C1, D1, E1	10i. Research and development is a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.	A1, D1,
10b. All products and systems are subject to failure. Many products and systems, however, can be fixed.	F1, G1	10d. Invention and innovation are creative ways to turn ideas into real things.	D1, F1, G1, G2	10g. Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it.	A1, B1,C1, D1, E1, F1	10j. Technological problems must be researched before they can be solved.	A1, C1, D1
		10e. The process of experimentation, which is common in science, can also be used to solve technological problems.	B2, D1, F1, G2	10h. Some technological problems are best solved through experimentation.	A3, D1, E1	10k. Not all problems are technological, and not every problem can be solved using technology.	C1, D1, E1
						10l. Many technological problems require a multidisciplinary approach.	B1, H1

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
11. Students will develop the abilities to apply the design process.							
11a. Brainstorm people's needs and wants and pick some problems that can be solved through the design process.	B2, D1, G1	11d. Identify and collect information about everyday problems that can be solved by technology, and generate ideas and requirements for solving a problem.	A1, B1, B2, B3, C2, D1, E1, F1, G2, H1	11h. Apply a design process to solve problems in and beyond the laboratory-classroom.	B1, D1, E1,	11m. Identify the design problem to solve and decide whether or not to address it.	B1, D1
11b. Build or construct an object using the design process.	A1, A2, A3, B2, B3, C2, D1, H1	11e. The process of designing involves presenting some possible solutions in visual form and then selecting the best solution(s) from many.	A1, B2, C2, G1, G2	11i. Specify criteria and constraints for the design.	A1, B1, D1, E1	11n. Identify criteria and constraints and determine how these will affect the design process.	A1, B1
11c. Investigate how things are made and how they can be improved.	B2, B3, D1, E1, F1, H1,	11f. Test and evaluate the solutions for the design problem.	A1 B1, B2, D1, G1, G2	11j. Make two-dimensional and three-dimensional representations of the designed solution.	A1, D1, E1	11o. Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.	A1, A2, C1, D1
		11g. Improve the design solution.	A1, B1, B2, D1, G1, G2	11k. Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed.	A1, A2, B1, D1, E1	11p. Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.	A1, C1, D1, E1
				11l. Make a product or system and document the solution.	A1, B1, D1, E1	11q. Develop and produce a product or system using a design process.	A2, B1
						11r. Evaluate final solutions & communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.	A1, B1, C1, D1

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
12. Students will develop the abilities to use and maintain technological products and systems.							
12a. Discover how things work.	A4, B1, B2, B3, D1, E1, F1, G1, H1	12d. Follow step-by-step directions to assemble a product.	B2	12h. Use information provided in manuals, protocols, or by experienced people to see and understand how things work.	A1, A2, B2, E1	12l. Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.	A1, F1
12b. Use hand tools correctly and safely and be able to name them correctly.	A2, A3, C2	12e. Select and safely use tools, products, and systems for specific tasks.	A2, A3, B1, B2, B3, D1, G2, H1	12i. Use tools, materials, and machines safely to diagnose, adjust, and repair systems.	A1, A2, A3, B1, D1, E1	12m. Diagnose a system that is malfunctioning and use tools, materials, and knowledge to repair it.	A1, A2, A3
12c. Recognize and use everyday symbols.	A2, C2	12f. Use computers to access and organize information.	G2, H1	12j. Use computers and calculators in various applications.	A1, D1, E1	12n. Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.	A1, A2, A3, H1
		12g. Use common symbols, such as numbers and words to communicate key ideas.	A1, C2	12k. Operate and maintain systems in order to achieve a given purpose.	A3, B1	12o. Operate systems so that they function in the way they were designed.	A3, H1
						12p. Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.	A1, D1

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
13. Students will develop the abilities to assess the impact of products and systems.							
13a. Collect information about everyday products and systems by asking questions.	A1, A2, A3, A4, B1, B2, B3, C2, D1, E1, F1, G1, H1	13c. Compare, contrast, and classify collected information in order to identify patterns.	A1, C2, F1, G1	13f. Design and use instruments to gather data.	A1, A3, D1, E1	13j. Collect information and evaluate its quality.	A1, A3
13b. Determine if the human use of a product or system creates positive or negative results.	F1, G1	13d. Investigate and assess the influence of a specific technology on the individual, family, community, and the environment.	F1, G1, G2	13g. Use data collected to analyze and interpret trends in order to identify the positive or negative effects of a technology.	A1, C1, D1, E1, G1	13k. Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and the environment.	A1, F1, F2, G1
				13h. Identify trends and monitor potential consequences of technological development.	A1, A2, A4, C1, D1, E1, G1	13l. Use assessment techniques, such as trend analysis and experimentation, to make decisions about the future development of technology.	A1, C1, D1
				13i. Interpret and evaluate the accuracy of the information obtained, and determine if it is useful.	A1, B2, E1	13m. Design forecasting techniques to evaluate the results of altering natural systems.	A1, C1, D1, F1

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
14. Students will develop an understanding of and be able to select and use medical technologies.							
14a. Vaccinations protect people from getting certain diseases.	F1, G1	14d. Vaccines are designed to prevent diseases from developing and spreading; medicines are designed to relieve symptoms and stop diseases from developing.	F1, G1, G2	14g. Advances and innovations in medical technologies are used to improve healthcare.	A2, A4, C1, D1, E1, F1, G1	14k. Medical technologies include prevention and rehabilitation, vaccines and pharmaceuticals, medical and surgical procedures, genetic engineering, and the systems within which health is protected and maintained.	F1, F2
14b. Medicine helps people who are sick to get better.	F1,G1	14e. Technological advances have made it possible to create new devices, to repair or replace certain parts of the body, and to provide a means for mobility.	A4, B1, B3, E1, F1, G1, G2	14h. Sanitation processes used in the disposal of medical products help to protect people from harmful organisms and disease, and shape the ethics of medical safety.	A2, A3, A4, B2,C1, D1, E1, G1	14l. Telemedicine reflects the convergence of technological advances in a number of fields, including medicine, telecommunications, virtual presence, computer engineering, informatics, artificial intelligence, robotics, materials science, and perceptual psychology.	F1, F2
14c. There are many products designed specifically to help people take care of themselves.	B1, E1, F1, G1	14f. Many tools and devices have been designed to help provide clues about health and to provide a safe environment.	A2, B1, E1, F1, G1, G2	14i. The vaccines developed for use in immunization require specialized technologies to support environments in which a sufficient amount of vaccines are produced.	A2, A3, A4, C1, D1, E1, G1	14m. The sciences of biotechnology and molecular biology have made it possible to manipulate the genetic information found in living creatures.	F1, F2
				14j. Genetic engineering involves modifying the structure of DNA to produce novel genetic make-ups.	A3, A4, C1, D1, E1, G1		

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
15. Students will develop an understanding of and be able to select and use agricultural technologies and related biotechnologies.							
15a. The use of technologies in agriculture makes it possible for food to be available year round and for the conservation resources.	A4, B1, F1, G1, H1	15c. Artificial ecosystems are human-made environments that are designed to function as a unit and are comprised of humans, plants, and animals.	A4, B1, C2, E1, F1, G2	15f. Technological advances in agriculture directly affect the time and number of people required to produce food for a large population.	A4, E1, G1	15k. Agriculture includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemical, and other useful products.	F1, F2
15b. There are many different tools necessary to control and make up the parts of an ecosystem.	A1, A2, A3, A4, B1, B3, E1, F1, G1, H1	15d. Most agricultural waste can be recycled.	A4, B1, B3, G1, G2, H1	15g. A wide range of specialized equipment and practices is used to improve the production of food, fiber, fuel, and other useful products and in the care of animals.	A1, A2, A3, C1, D1, E1, F1, G1	15l. Biotechnology has applications in such areas as agriculture, pharmaceuticals, food and beverages, medicine, energy, the environment, and genetic engineering.	F1, F2
		15e. Many processes used in agriculture require different procedures, products, or systems.	A4, B1, B3, D1, G1, G2, H1	15h. Biotechnology applies the principles of biology to create commercial products or processes.	A3, D1, E1, G1	15m. Conservation is the process of controlling soil erosion, reducing sediment in waterways, conserving water, and improving water quality.	F1, F2
				15i. Artificial ecosystems are human-made complexes that replicate some aspects of the natural environment.	C1, D1, E1	15n. The engineering design and management of agricultural systems requires knowledge of artificial ecosystems and the effects of technological development on flora and fauna.	F1, F2
				15j. The development of refrigeration, freezing, dehydration, preservation, and irradiation provide long-term storage of food and reduce the health risks caused by tainted food.	A2, A3, C1, D1, E1, F1, G1		

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
16. Students will develop an understanding of and be able to select and use energy and power technologies.							
16a. Energy comes in many forms.	A4, B1, B3, E1,	16c. Energy comes in different forms.	A4, B1,C2, E1, G2	16e. Energy is the capacity to do work.	A1, E1	16j. Energy cannot be created nor destroyed; however, it can be converted from one form to another.	A1, B1, D1, E1
16b. Energy should not be wasted.	G1, H1	16d. Tools, machines, products, and systems use energy in order to do work.	B1, E1, G2	16f. Energy can be used to do work, using many processes.	A1, A2, E1	16k. Energy can be grouped into major forms: thermal, radiant, electrical, mechanical, chemical, nuclear, and others.	B1, E1
				16g. Power is the rate at which energy is converted from one form to another or transferred from one place to another, or the rate at which work is done.	A1, E1	16l. It is impossible to build an engine to perform work that does not exhaust thermal energy to the surroundings.	A1, B1, D1, E1
				16h. Power systems are used to drive and provide propulsion to other technological products and systems.	A1, A2, A3, D1, E1	16m. Energy resources can be renewable or nonrenewable.	A1, B1, D1, E1
				16i. Much of the energy used in our environment is not used efficiently.	A1, A3, A4, E1	16n. Power systems must have a source of energy, a process, and loads.	B1, E1

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
17. Students will develop an understanding of and be able to select and use information and communication technologies.							
17a. Information is data that has been organized.	C1	17d. The processing of information through the use of technology can be used to help humans make decisions and solve problems.	A1, B2, D1, G1, G2	17h. Information and communication systems allow information to be transferred from human to human, human to machine, and machine to human.	A1, B1, E1	17 l. Information and communication technologies include the inputs, processes, and outputs associated with sending and receiving information.	A1, D1
17b. Technology enables people to communicate by sending and receiving information over a distance.	F1, G1, H1	17e. Information can be acquired and sent through a variety of technological sources, including print and electronic media.	B3, F1, G1, G2, H1	17i. Communication systems are made up of a source, encoder, transmitter, receiver, decoder, storage, retrieval, and destination.	A1, B1, E1	17m. Information and communication systems allow information to be transferred from human to human, human to machine, machine to machine.	A1, A3, D1
17c. People use symbols when they communicate by technology.	A1, C2, F1	17f. Communication technology is the transfer of messages among people and/or machines over distances through the use of technology.	F1, G1, G2, H1	17j. The design of a message is influenced by such factors as the intended audience, medium, purpose, and nature of the message.	A2, B1, D1, E1, G1	17n. Information and communication systems can be used to inform, persuade, entertain, manage, and educate.	A1, A3, B1, D1, H1,
		17g. Letters, characters, icons, and signs are symbols that represent ideas, quantities, elements, and operations.	A1, C2, F1, G2	17k. The use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas.	A1, A2, E1	17o. Communication systems are made up of a source, encoder, transmitter, receiver, decoder, storage, retrieval, and destination.	A1, B1,
						17p. There are many ways to communicate information, such as graphic and electronic means.	A1, B1, D1, E1
						17q.Technological knowledge & processes are communicated using symbols, measurement, conventions, icons, graphic images, & languages that incorporate a variety of visual, auditory, & tactile stimuli.	A1, A3, B1, E1,

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
18. Students will develop an understanding of and be able to select and use transportation technologies.							
18a. A transportation system has many parts that work together to help people travel.	A4, B1	18d. The use of transportation allows people and goods to be moved from place to place.	B2, E1, F1, G2	18h. Governmental regulations often influence the design and operation of transportation systems.	A1, A2, A3, D1, E1	18j. Transportation plays a vital role in the operation of other technologies, such as manufacturing, construction, communication, health and safety, and agriculture.	A3, F1
18b. Vehicles move people or goods from one place to another in water, air, or space and on land.	B2, E1, F1	18e. A transportation system may lose efficiency or fail if one part is missing or malfunctioning or if a subsystem is not working.	B1, F1, G1, G2	18i. Processes, such as receiving, holding, storing, loading, moving, unloading, delivering, evaluating, marketing, managing, communication, and using conventions are necessary for the entire transportation system to operate efficiently.	A1, A2, A3, B1, D1, E1	18k. Intermodalism is the use of different modes of transportation, such as highways, railways, and waterways, as part of an interconnected system that can move people and goods easily from one mode to another.	A3, E1, F2, G1, H1,
18c. Transportation vehicles need to be cared for to prolong their use.	B1					18l. Transportation services and methods have led to a population that is regularly on the move.	A3, F1, F2, G1, H1,
						18m. The design of intelligent and non-intelligent transportation systems depends on many processes and innovative techniques.	A2, A3, B1, D1, F2

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
19. Students will develop an understanding of and be able to select and use manufacturing technologies							
19a. Manufacturing systems produce products in quantity.	A4, B1, E1, H1	19c. Processing systems convert natural materials into products.	B3, G2, H1	19f. Manufacturing systems use mechanical processes that change the form of materials through the processes of separating, forming, combining, and conditioning them.	A1, A2, A3, B1, D1, E1	19l. Servicing keeps products in good operating condition.	A1, A3, B1, E1
19b. Manufactured products are designed.	D1, F1	19d. Manufacturing processes include designing products, gathering resources, & using tools to separate, form, & combine materials in order to produce products.	A1, A2, A3, B1, B2, B3, D1, G2, H1	19g. Manufacturing goods may be classified as durable and nondurable.	E1	19m. Materials have different qualities and may be classified as natural, synthetic, or mixed.	B1, D1, E1, G1, H1
		19e. Manufacturing enterprises exist because of a consumption of goods.	F1, G2	19h. The manufacturing process includes the designing, developmnt, making, and servicing of products and systems.	A1, A3, B1, D1, E1, H1	19n. Durable goods are designed to operate for a long period of time, while non-durable goods are designed to operate for a short period of time.	B1, D1
				19i. Chemical technologies are used to modify or alter chemical substances.	A2, E1	19o. Manufacturing systems may be classified into types, such as customized production, batch production, and continuous production.	A2, A3, B1,
				19j. Materials must first be located before they can be extracted from the earth through such processes as harvesting, drilling, and mining.	A2, A3, D1, E1	19p. The interchangeability of parts increases the effectiveness of manufacturing processes.	A2, D1,
				19k. Marketing a product involves informing the public about it as well as assisting in selling and distributing it.	A1, A4, C1, D1, E1, G1	19q. Chemical technologies provide a means for humans to alter or modify materials and to produce chemical products.	A2, E1, G1, H1
						19r. Marketing involves establishing a product's identity, conducting research on its potential, advertising it, distributing it, and selling it.	A1, A4, D1,

Standards Benchmarks	K-2 NH Program Objectives	*Standards Benchmarks*	3-5 NH Program Objectives	*Standards Benchmarks*	6-8 NH Program Objectives	*Standards Benchmarks*	9 -12 NH Program Objectives
20. Students will develop an understanding of and be able to select and use construction technologies.							
20a. People live, work, and go to school in buildings, which are of different types: houses, apartments, office buildings, and schools.	B1	20c. Modern communities are usually planned according to guidelines.	B3, G1, G2, H1	20f. The selection of designs for structures is based on factors such as building laws and codes, style, convenience, cost, climate, and function.	A1, A2, A3, B1, B2, E1, G1	20j. Infrastructure is the underlying base or basic framework of a system.	D1,
20b. The type of structure determines how the parts are put together.	B1	20d. Structures need to be maintained.	B1, F1, G2	20g. Structures rest on a foundation.	A2	20k.Structures are constructed using a variety of processes and procedures.	A1, A2, B1,
		20e. Many systems are used in buildings.	A4, G2	20h. Some structures are temporary, while others are permanent.	A2, D1, E1	20l. The design of structures includes a number of requirements.	A1, A2, A4, D1, E1, F2
				20i. Buildings generally contain a variety of subsystems.	A2, D1, E1	20m. Structures require maintenance, alteration, or renovation periodically to improve them or the altar their intended use.	A1, A2, A4, B1, D1, F2, H1
						20n. Structures can include prefabricated materials.	A2, D1

Appendix B: Comparing ITEA Standards to NH Framework Objectives

STANDARD	NH Technology Education Program Objectives	NH English Language Arts Curriculum Framework	NH Mathematics Curriculum Framework	NH Science Curriculum Framework	NH Social Studies Curriculum Framework	NH Career Development Curriculum Framework	NH Arts Frameworks NH Phys. Ed. Frameworks *
1. Students will develop an understanding of the characteristics and scope of technology.	*K-2*	Written & Oral RC: 2, C: 1		SPS: 1, 2, 3	Skill: 2.1 Theme: A, B, C, D, E, F, G	1, 3, 4, 5	
	3 – 5	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral RC: 2, C: 1		SPS: 1, 2, 3 ESS: 1 LS: 2 PS: 2	Skill: 2.1 Theme: A, B, C, D, E, F, G	1, 3, 4, 5	
	6 – 8	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral RC: 2, C: 1		SPS: 1, 2, 3, 4 ESS: 1, 2, 3, 4 LS: 2, 5 PS: 1, 2, 4	Skill: 2.1 Theme: A, B, C, D, E, F, G	1, 2, 3, 4, 5	
	9 -12	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral RC: 2, C: 1	N&O: 4, 6, 7, 8 G&M: 7, 10 F&A: 1, 4 DSP: 1, 2, 6 CCR:1, 2, 3	SPS: 1, 2, 3, 4 ESS: 1, 2, 3, 4 LS: 2, 5 PS: 1, 2, 4	Skill: 2.1 Theme: A, B, C, D, E, F, G	1, 2, 3, 4, 5	

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2. Students will develop an understanding of the core concepts of technology.	*K-2*	Written & Oral C: 1		SPS: 2	Skills: 2.1, 2.2	1, 3, 4, 5	
	3 – 5	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral C: 1		SPS: 2 ESS: 2 LS: 2	Skills: 2.1, 2.2	1, 3, 4, 5	
	6 – 8	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral C: 1		SPS: 2, 3, 4 ESS: 2, 3, 4 LS: 2 PS: 1, 2, 3, 4	Skills: 2.1, 2.2	1, 2, 3, 4, 5	
	9 -12	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral C: 1	N&O: 4, 6, 7, 8 G&M: 7, 10 F&A: 1, 4 DSP: 1, 2, 6 CCR:1, 2, 3 F&A: 3	SPS: 2, 3, 4 ESS: 2, 3, 4 LS: 2 PS: 1, 2, 3, 4	Skills: 2.1, 2.2	1, 2, 3, 4, 5	

STANDARD	NH Technology Education Program Objectives	NH English Language Arts Curriculum Framework	NH Mathematics Curriculum Framework	NH Science Curriculum Framework	NH Social Studies Curriculum Framework	NH Career Development Curriculum Framework	NH Arts Frameworks NH Phys. Ed. Frameworks *
3. Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.	*K-2*	Written & Oral RC: 2	CCR: 3		Skills: 2.2, 2.3 Themes: A, B, C, D, E, F, G	1, 3, 4, 5, 7	T: 3
	3 – 5	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral RC: 2	CCR:3	LS: 2	Skills: 2.2, 2.3 Themes: A, B, C, D, E, F, G	1, 3, 4, 5, 7	T: 3
	6 – 8	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral RC: 2	CCR:3	SPS: 3 ESS 1, 2, 3, 4 LS: 2, 5 PS: 4	Skills: 2.2, 2.3 Themes: A, B, C, D, E, F, G	1, 2, 3, 4, 5, 7	T: 3
	9 -12	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral RC: 2	N&O: 4, 6, 7, 8 G&M: 7, 10 G&M: HS:2 F&A: 1, 4 DSP: 1, 2, 6 CCR:1, 2, 3 G&S: 5, 6, 7	SPS: 3 ESS 1, 2, 3, 4 LS: 2, 5 PS: 4	Skills: 2.2, 2.3 Themes: A, B, C, D, E, F, G	1, 2, 3, 4, 5, 7	T: 3

STANDARD	NH Technology Education Program Objectives	NH English Language Arts Curriculum Framework	NH Mathematics Curriculum Framework	NH Science Curriculum Framework	NH Social Studies Curriculum Framework	NH Career Development Curriculum Framework	NH Arts Frameworks NH Phys. Ed. Frameworks *
4. Students will develop an understanding of the cultural, social, economic, and political effects of technology.	*K-2*	Written & Oral RC: 2		SPS: 1	Skills: 2.1, 2.2, 2.3 Themes: A, B, C, D, E, F, G	1, 3, 4, 5	PE: 1
	3 – 5	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral RC: 2		SPS: 1, 4 LS: 2	Skills: 2.1, 2.2, 2.3 Themes: A, B, C, D, E, F, G	1, 3, 4, 5	PE: 1
	6 – 8	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral RC: 2		SPS: 1, 3, 4 ESS: 1, 2, 3, 4 LS: 2, 3 PS: 4	Skills: 2.1, 2.2, 2.3 Themes: A, B, C, D, E, F, G	1, 2, 3, 4, 5	PE: 1
	9 -12	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral RC: 2	N&O: 4, 6, 7, 8 G&M: 7, 10 F&A: 1, 4 DSP: 1, 2, 4, 6 CCR:1, 2, 3 PRP: 2	SPS: 1, 3, 4 ESS: 1, 2, 3, 4 LS: 2, 3 PS: 4	Skills: 2.1, 2.2, 2.3 Themes: A, B, C, D, E, F, G	1, 2, 3, 4, 5	PE: 1

STANDARD	NH Technology Education Program Objectives	NH English Language Arts Curriculum Framework	NH Mathematics Curriculum Framework	NH Science Curriculum Framework	NH Social Studies Curriculum Framework	NH Career Development Curriculum Framework	NH Arts Frameworks NH Phys. Ed. Frameworks *
5. Students will develop an understanding of the effects of technology on the environment.	*K-2*	Written & Oral RC: 1		SPS: 1, 2	Skills: 2.2, 2.3 Themes: C, D, F, G	1, 3, 4, 5	PE: 1
	3 – 5	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral RC: 1		SPS: 1, 2, 3, 4 ESS: 2, 4 LS: 2 PS: 1, 2	Skills: 2.2, 2.3 Themes: C, D, F, G	1, 3, 4, 5	PE: 1
	6 – 8	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral RC: 1		SPS: 1, 2, 3, 4 ESS: 1, 2, 3, 4 LS: 2 PS: 1, 2, 4	Skills: 2.2, 2.3 Themes: C, D, F, G	1, 2, 3, 4, 5	PE: 1
	9 -12	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral RC: 1	N&O: 4, 6, 7, 8 G&M: 7, 10 F&A: 1, 2, 4 DSP: 1, 2, 6 CCR:1, 2, 3 PRP:2	SPS: 1, 2, 3, 4 ESS: 1, 2, 3, 4 LS: 2 PS: 1, 2, 4	Skills: 2.2, 2.3 Themes: C, D, F, G	1, 2, 3, 4, 5	PE: 1

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6. Students will develop an understanding of the role of society in the development and use of technology.	*K-2*	Written & Oral C: 1		SPS: 1	Skills: 2.1, 2.2, 2.3 Themes: A, C, D, E, F, G	1, 3, 4, 5, 6	
	3 – 5	Reading IT: 1, 2 B: 3 Written & Oral C: 1		SPS: 1, 3, 4 ESS: 3, 4 LS: 2	Skills: 2.1, 2.2, 2.3 Themes: A, C, D, E, F, G	1, 3, 4, 5, 6	
	6 – 8	Reading IT: 1, 2 B: 3 Written & Oral C: 1		SPS: 1, 2, 3, 4 ESS: 2, 3, 4 LS: 2, 3, 4, 5 PS: 4	Skills: 2.1, 2.2, 2.3 Themes: A, C, D, E, F, G	1, 2, 3, 4, 5, 6	
	9 -12	Reading IT: 1, 2 B: 3 Written & Oral C: 1	N&O: 4, 6, 7, 8 G&M: 7, 10 F&A: 1, 4 DSP: 1, 2, 4, 6 CCR:1, 2, 3 PRP: 2	SPS: 1, 2, 3, 4 ESS: 1, 2, 3, 4 LS: 2, 3, 4, 5 PS: 4	Skills: 2.1, 2.2, 2.3 Themes: A, C, D, E, F, G	1, 2, 3, 4, 5, 6	

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7.Students will develop an understanding of the influence of technology on history.	*K-2*			SPS: 1, 2	Skills: 2.1, 2.2, 2.3 Themes: A, C, D, F, G	1, 3, 4, 5	
	3 – 5	Reading IT: 1, 2 B: 3		SPS: 1, 3, 4 ESS: 2, 4 LS: 2	Skills: 2.1, 2.2, 2.3 Themes: A, C, D, F, G	1, 3¸ 4, 5	
	6 – 8	Reading IT: 1, 2 B: 3 Written & Oral EW: 5		SPS: 1, 2, 3, 4 ESS: 2, 3, 4 LS: 2, 3, 4, 5	Skills: 2.1, 2.2, 2.3 Themes: A, C, D, F, G	1, 2, 3, 4, 5	
	9 -12	Reading IT: 1, 2 B: 3 Written & Oral EW: 5	N&O: 4, 6, 7, 8 G&M: 7, 10 F&A: 1, 4 DSP: 1, 2, 6 CCR:1, 2, 3	SPS: 1, 2, 3, 4 ESS: 2, 3, 4 LS: 2, 3, 4, 5	Skills: 2.1, 2.2, 2.3 Themes: A, C, D, F, G	1, 2, 3, 4, 5	

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8. Students will develop an understanding of the attributes of design.	*K-2*	Written & Oral IW: 1, 2		SPS: 1, 2, 3, 4		1, 3, 4, 5	T: 3 V: 1, 2, 5
	3 – 5	Reading V: 2 IT: 1, 2 Written & Oral IW: 1, 2		SPS: 1, 2, 3, 4		1, 3, 4, 5	T: 3 V: 1, 2, 5
	6 – 8	Reading V: 2 IT: 1, 2 Written & Oral IW: 1, 2		SPS: 1, 2, 3, 4 ESS: 4 LS: 5 PS: 4		1, 2, 3, 4, 5	T: 3 V: 1, 2, 5
	9 -12	Reading V: 2 IT: 1, 2 Written & Oral IW: 1, 2	N&O: 1, 2, 4, 6, 7, 8 G&M: 5, 6, 7, 9, 10 F&A: 1, 2, 3, 4 DSP: 1, 2, 3, 6 CCR:1, 2, 3 PRP: 2	SPS: 1, 2, 3, 4 ESS: 4 LS: 5 PS: 4		1, 2, 3, 4, 5	T: 3 V: 1, 2, 5

STANDARD	NH Technology Education Program Objectives	NH English Language Arts Curriculum Framework	NH Mathematics Curriculum Framework	NH Science Curriculum Framework	NH Social Studies Curriculum Framework	NH Career Development Curriculum Framework	NH Arts Frameworks NH Phys. Ed. Frameworks *
9. Students will develop an understanding of engineering design.	*K-2*	Written & Oral IW: 1, 2 C: 1				1, 3, 4, 5, 6	V: 1, 6
	3 – 5	Reading V: 1, 2 IT: 1, 2 Written & Oral IW: 1, 2 C: 1				1, 2, 3, 4, 5, 6	V: 1, 6
	6 – 8	Reading V: 1, 2 IT: 1, 2 Written & Oral IW: 1, 2 C: 1		SPS: 1, 2, 3, 4 ESS: 4		1, 2, 3, 4, 5, 6	V: 1, 6
	9 -12	Reading V: 1, 2 IT: 1, 2 Written & Oral IW: 1, 2 C: 1	N&O: 1, 2, 4, 6, 7, 8 G&M: 5, 6, 7, 9, 10 F&A: 1, 2, 3, 4 DSP: 1, 2, 3, 6 CCR:1, 2, 3 PRP: 2	SPS: 1, 2, 3, 4 ESS: 4 LS: 5 PS: 4		1, 2, 3, 4, 5, 6	V: 1, 6

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10. Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	*K-2*	Written & Oral SL: 1 IW: 1, 2, 3 C: 1	N&O: 5, 7 G&M: 7 F&A: 1, 3 DSP: 1, 6 PRP: 1, 2 CCR: 1, 2, 3	SPS: 1, 2, 4	Skill: 2.1	1, 3, 4, 5	
	3 – 5	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral SL: 1 IW: 1, 2, 3 C: 1	N&O: 5, 7 G&M: 7 F&A: 1, 3 DSP: 1, 6 PRP: 1, 2 CCR: 1, 2, 3	SPS: 1, 2, 3, 4	Skill: 2.1	1, 3, 4, 5	
	6 – 8	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral SL: 1 IW: 1, 2, 3 C: 1	N&O: 5, 7 G&M: 7 F&A: 1, 3 DSP: 1, 6 PRP: 1, 2 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 4	Skill: 2.1	1, 2, 3, 4, 5	
	9 -12	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral SL: 1 IW: 1, 2, 3 C: 1	N&O: 1, 4, 6, 7, 8 DSP: 1, 2, 3, 4, 6 PRP: 2 G&M: 7 ,10 F&A: 1, 3, 4 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 4 LS: 4, 5	Skill: 2.1	1, 2, 3, 4, 5	

STANDARD	NH Technology Education Program Objectives	NH English Language Arts Curriculum Framework	NH Mathematics Curriculum Framework	NH Science Curriculum Framework	NH Social Studies Curriculum Framework	NH Career Development Curriculum Framework	NH Arts Frameworks NH Phys. Ed. Frameworks *
11. Students will develop the abilities to apply the design process.	*K-2*	Written & Oral RC: 1	F&A: 1, 3 DSP: 1, 2, 3, 4, 5, 6 PRP: 1, 2 CCR: 1, 2, 3			1, 3, 4, 5	T: 3 V: 1, 2, 5, 6
	3 – 5	Written & Oral RC: 1	F&A: 1, 3 DSP: 1, 2, 3, 4, 5, 6 PRP: 1, 2 CCR: 1, 2, 3	SPS: 1, 2, 3, 4		1, 3, 4, 5	T: 3 V: 1, 2, 5, 6
	6 – 8	Written & Oral RC: 1	F&A: 1, 3 DSP: 1, 2, 3, 4, 5, 6 PRP: 1, 2 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 4		1, 2, 3, 4, 5	T: 3 V: 1, 2, 5, 6
	9 -12	Written & Oral RC: 1	N&O: 1, 4, 6, 7, 8 F&A: 1, 2, 3, 4 DSP: 1, 2, 3, 4 PRP: 2 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 4 LS: 5		1, 2, 3, 4, 5	T: 3 V: 1, 2, 5, 6

STANDARD	NH Technology Education Program Objectives	NH English Language Arts Curriculum Framework	NH Mathematics Curriculum Framework	NH Science Curriculum Framework	NH Social Studies Curriculum Framework	NH Career Development Curriculum Framework	NH Arts Frameworks NH Phys. Ed. Frameworks *
12. Students will develop the abilities to use and maintain technological products and systems.	*K-2*		N&O: 4 G&M: 8 F&A: 1 DSP: 1, 2, 3, 4, 5, 6, PRP: 1, 2 CCR: 1, 2, 3	SPS: 1, 2, 4	Skill: 2.1 Themes: A, C, D, F, G	1, 3, 4, 5, 6	
	3 – 5	Reading V: 2 IT: 1, 2 B: 3	N&O: 4 G&M: 8 F&A: 1 DSP: 1, 2, 3, 4, 5, 6, PRP: 1, 2 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 LS: 2	Skill: 2.1 Themes: A, C, D, F, G	1, 3, 4, 5, 6	
	6 – 8	Reading V: 2 IT: 1, 2 B: 3	N&O: 4 G&M: 8 F&A: 1 DSP: 1, 2, 3, 4, 5, 6, PRP: 1, 2 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 4 LS: 2, 5	Skill: 2.1 Themes: A, C, D, F, G	1, 2, 3, 4, 5, 6	
	9 -12	Reading V: 2 IT: 1, 2 B: 3	N&O: 1, 4, 6, 7, 8 G&M: 7, 10 F&A: 1, 3, 4 DSP: 1, 2, 6 PRP: 2 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 4 LS: 2, 5	Skill: 2.1 Themes: A, C, D, F, G	1, 2, 3, 4, 5, 6	

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13. Students will develop the abilities to assess the impact of products and systems.	*K-2*	Written & Oral EW: 2	N&O: 4 G&M: 8 F&A: 1, 4 DSP: 1, 2, 3, 4, 5, 6 PRP: 1, 2 CCR: 1, 2, 3			1, 3, 4, 5,	
	3 – 5	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral EW: 2	N&O: 4 G&M: 8 F&A: 1, 4 DSP: 1, 2, 3, 4, 5, 6 PRP: 1, 2 CCR: 1, 2, 3	SPS: 1, 2, 3, 4		1, 2, 3, 4, 5,	
	6 – 8	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral EW: 2	N&O: 4 G&M: 8 F&A: 1, 4 DSP: 1, 2, 3, 4, 5, 6 PRP: 1, 2 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 4 LS: 5		1, 2, 3, 4, 5,	
	9 -12	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral EW: 2	N&O: 1, 4, 6, 7, 8 G&M: 7, 10 F&A: 1, 3, 4 DSP: 1, 2, 4 PRP: 1, 2, 6 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 4 LS: 5		1, 2, 3, 4, 5,	

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14. Students will develop an understanding of and be able to select and use medical technologies.	*K-2*	Written & Oral OC: 1, 2				1, 3, 4, 5, 6	PE: 1
	3 – 5	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral OC: 1, 2		SPS: 3		1, 2, 3, 4, 5, 6	PE: 1
	6 – 8	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral OC: 1, 2	N&O: 1, 4, 6, 7, 8 G&M: 7, 10 F&A: 1, 3, 4 DSP: 1, 2, 6 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 4 LS: 1, 2, 3, 4, 5 PS: 1, 2, 3, 4		1, 2, 3, 4, 5, 6	PE: 1
	9 -12	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral OC: 1, 2	N&O: 1, 4, 6, 7, 8 G&M: 6, 7, 10 F&A: 1, 2, 3, 4 DSP 1, 2, 4, 6 PRP: 2 CCR:1, 2, 3	SPS: 1, 2, 3, 4 ESS: 4 LS: 1, 2, 3, 4, 5 PS: 1, 2, 3, 4		1, 2, 3, 4, 5, 6	PE: 1

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15. Students will develop an understanding of and be able to select and use agricultural technologies and related biotechnologies.	*K-2*	Written & Oral OC: 1, 2		SPS: 1, 2, 3 PS: 1		1, 3, 4, 5, 6	
	3 – 5	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral OC: 1, 2		SPS: 1, 2, 3 LS: 2, 3 PS: 1		1, 2, 3, 4, 5, 6	
	6 – 8	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral OC: 1, 2	N&O: 1, 4, 6, 7, 8 G&M: 7, 10 F&A: 1, 3, 4 DSP: 1, 2, 6 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 4 LS: 1, 2, 3, 4, 5 PS: 1, 2, 3, 4		1, 2, 3, 4, 5, 6	
	9 -12	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral OC: 1, 2	N&O: 1, 4, 6, 7, 8 G&M: 6, 7, 10 PRP: 2 F&A: 1, 3, 4 DSP: 1, 2, 6 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 4 LS: 1, 2, 3, 4, 5 PS: 1, 2, 3, 4		1, 2, 3, 4, 5, 6	

STANDARD	NH Technology Education Program Objectives	NH English Language Arts Curriculum Framework	NH Mathematics Curriculum Framework	NH Science Curriculum Framework	NH Social Studies Curriculum Framework	NH Career Development Curriculum Framework	NH Arts Frameworks NH Phys. Ed. Frameworks *
16. Students will develop an understanding of and be able to select and use energy and power technologies.	*K-2*	Written & Oral IW: 1, 2, 3				1, 3, 4, 5, 6	T: 3
	3 – 5	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral IW: 1, 2, 3		SPS: 1, 2, 3, 4 LS: 2 PS: 1, 2, 3		1, 2, 3, 4, 5, 6	T: 3
	6 – 8	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral IW: 1, 2, 3	N&O: 1, 4, 6, 7, 8 G&M: 7, 10 F&A: 1, 3, 4 DSP: 1, 2, 6 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 2, 4 LS: 2 PS: 1, 2, 3, 4		1, 2, 3, 4, 5, 6	T: 3
	9 -12	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral IW: 1, 2, 3	N&O: 1, 4, 6, 7, 8 G&M: 5, 6, 7, 9, 10 F&A: 1, 3, 4 DSP: 1, 2, 6 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 2, 4 LS: 2 PS: 1, 2, 3, 4		1, 2, 3, 4, 5, 6	T: 3

STANDARD	NH Technology Education Program Objectives	NH English Language Arts Curriculum Framework	NH Mathematics Curriculum Framework	NH Science Curriculum Framework	NH Social Studies Curriculum Framework	NH Career Development Curriculum Framework	NH Arts Frameworks NH Phys. Ed. Frameworks *
17. Students will develop an understanding of and be able to select and use information and communication technologies.	*K-2*	Written & Oral SL: 1 RC: 1		SPS: 2 ESS: 1		1, 3, 4, 5, 6	V: 1, 2, 5, 6
	3 – 5	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral SL: 1 RC: 1		SPS: 1, 2, 4 ESS: 1		1, 2, 3, 4, 5, 6	V: 1, 2, 5, 6
	6 – 8	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral SL: 1 RC: 1	N&O: 1, 4, 6, 7, 8 G&M: 7, 10 F&A: 1, 3, 4 DSP: 1, 2, 6 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 1, 4		1, 2, 3, 4, 5, 6	V: 1, 2, 5, 6
	9 -12	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral SL: 1 RC: 1	N&O: 1, 4, 6, 7, 8 G&M: 7, 10 F&A: 1, 3, 4 DSP: 1, 2 , 6 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 1, 4		1, 2, 3, 4, 5, 6	V: 1, 2, 5, 6

STANDARD	NH Technology Education Program Objectives	NH English Language Arts Curriculum Framework	NH Mathematics Curriculum Framework	NH Science Curriculum Framework	NH Social Studies Curriculum Framework	NH Career Development Curriculum Framework	NH Arts Frameworks NH Phys. Ed. Frameworks *
18. Students will develop an understanding of and be able to select and use transportation technologies.	*K-2*	Written & Oral OC: 1, 2				1, 3, 4, 5, 6	
	3 – 5	V: 1, 2 IT: 1, 2 B: 3 Written & Oral OC: 1, 2		SPS: 1, 2, 3, 4 ESS: 1		1, 2, 3, 4, 5, 6	
	6 – 8	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral OC: 1, 2	N&O: 1, 4, 6, 7, 8 G&M: 7, 10 F&A: 1, 3, 4 DSP: 1, 2, 6 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 1, 4 PS: 4		1, 2, 3, 4, 5, 6	
	9 -12	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral OC: 1, 2	N&O: 1, 4, 6, 7, 8 G&M: 6, 7, 10 F&A: 1, 3, 4 DSP: 1, 2 , 6 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 1, 4 LS: 5 PS: 4		1, 2, 3, 4, 5, 6	

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19. Students will develop an understanding of and be able to select and use manufacturing technologies.	*K-2*	Written & Oral OC: 1, 2		SPS: 1, 2 PS: 1		1, 3, 4, 5, 6	
	3 – 5	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral OC: 1, 2		SPS: 1, 2, 3, 4 LS: 2 PS: 1, 2		1, 2, 3, 4, 5, 6	
	6 – 8	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral OC: 1, 2	N&O: 1, 4, 6, 7, 8 G&M: 7, 10 F&A: 1, 3, 4 DSP: 1, 2, 6 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 1, 4 LS: 2, 4, 5 PS: 1, 2, 3, 4		1, 2, 3, 4, 5, 6	
	9 -12	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral OC: 1, 2	N&O: 1, 4, 6, 7, 8 G&M: 5, 6, 7, 10 F&A: 1, 3, 4 DSP: 1, 2 , 6 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 1, 4 LS: 2, 4, 5 PS: 1, 2, 3, 4		1, 2, 3, 4, 5, 6	

STANDARD	NH Technology Education Program Objectives	NH English Language Arts Curriculum Framework	NH Mathematics Curriculum Framework	NH Science Curriculum Framework	NH Social Studies Curriculum Framework	NH Career Development Curriculum Framework	NH Arts Frameworks NH Phys. Ed. Frameworks *
20. Students will develop an understanding of and be able to select and use construction technologies.	*K-2*	Written & Oral OC: 1, 2		SPS: 1, 2 PS: 1		1, 3, 4, 5, 6	T: 3
	3 – 5	Reading V: 1, 2 IT: 1, 2 Written & Oral OC: 1, 2 B: 3		SPS: 1, 2, 3, 4 PS: 1		1, 2, 3, 4, 5, 6	T: 3
	6 – 8	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral OC: 1, 2	N&O: 1, 4, 6, 7, 8 G&M: 7, 10 F&A: 1, 3, 4 DSP: 1, 2, 6 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 1, 2, 3, 4 PS: 1, 4		1, 2, 3, 4, 5, 6	T: 3
	9 -12	Reading V: 1, 2 IT: 1, 2 B: 3 Written & Oral OC: 1, 2	N&O: 1, 4, 6, 7, 8 G&M: 2, 5, 6, 7, 8, 10 F&A: 1, 3, 4 DSP: 1, 2 , 6 CCR: 1, 2, 3	SPS: 1, 2, 3, 4 ESS: 1, 2, 3, 4 LS: 1, 2, 3, 4, 5 PS: 1, 4		1, 2, 3, 4, 5, 6	T: 3

* Under the Arts/Physical Education Frameworks, V stands for Visual, T stands for Theater, PE stands for Physical Education

Ed 306.17 Class Size.

(a) Class size for instructional purposes, in each school shall:

(1) Be:

a. Kindergarten – grade 2, 25 students or fewer per teacher, provided that each school shall strive to achieve the class size of 20 students or fewer per teacher;

b. Grades 3 – 5, 30 students or fewer per teacher, provided that each school shall strive to achieve the class size of 25 students or fewer per teacher; and

c. Middle and senior high school, 30 students or fewer per teacher; or

(2) Have received approval under alternative compliance requirements as provided in Ed 306.29, for any category listed in (1) above that does not meet the standards in (1) above.

(b) These class size requirements may be exceeded for study halls, band and chorus, and other types of large group instruction, including but not limited to, lectures, combined group instruction, and showing of educational television and films.

(c) In the interest of safety, the maximum number of students in laboratory classes in such areas as science and career and technical education shall be determined by the number of work stations and the size and design of the area. In no case shall the number of students in laboratory classes exceed 24.

(g) The following shall apply relative to required program areas and credits:

(1) Consistent with Ed 306, the local school board shall verify in writing to the commissioner that each high school shall offer courses which total at least 45 credits distributed as shown in Table 306-1 when the school seeks approval or renewal of approval under Ed 306.28;

(2) Each high school's credit course offerings shall be composed of single credit courses, fractional credit courses, or integrated sequences of courses, or any combination of these;

(3) Each high school may use any relevant title to identify a particular course;

(4) Local school boards may propose innovative ways to meet or exceed the requirements in Table 306-1, pursuant to Ed 306.29; and

(5) The required credits in program areas offered by each high school shall be distributed as specified in Table 306-1 below:

Table 306-1 Required Program Areas and Credits

Required Program Areas	**Credit(s)**
Arts education	3 credits
Business education	5 credits
Information and communication technologies	½ credit
Family and consumer science	3 credits
World languages	5 credits
Health education	½ credit
Physical education	2 credits
Technology education	4 credits
English	6 credits
Mathematics	6 credits
Science	5 credits
Social studies	5 credits

Ed 306.47 Technology Education Program.

(a) The local school board shall require that a technology education program in each elementary and middle school provides:

(1) Opportunities for students to develop an understanding of the technological world in which they live and will someday work;

(2) Opportunities for students to develop positive attitudes and knowledge about industry and technology in the cluster areas of information communication, energy/power/transportation, and materials and process technology;

(3) Opportunities for students to develop a knowledge and understanding of the free-enterprise system and to promote the development of problem-solving skills as well as basic skills in planning, designing, fabricating, and evaluating technical processes; and

(4) Systematic instruction and activities designed to enable students to:

a. Acquire an understanding of technical processes, the practical application of mathematics and scientific principles, and the interrelationships between technology education and other subject areas in the school curriculum;

b. Be aware of the right to a safe work environment as well as the safe and appropriate use of tools, small machines, and processes;

c. Understand industry and technology, their systematic structures, and their place in our culture and in the free-enterprise system;

d. Learn leadership and group-process skills;

e. Recognize and build upon individual talents and interests; and

f. Become familiar with opportunities and requirements for careers in communications, energy/power/ transportation, and materials and process technology cluster areas.

(b) The local school board shall require that a technology education program in each high school provides:

(1) Opportunities for students to develop insight, understanding, and application of technological concepts, processes, and systems to solve future problems and to satisfy future needs;

(2) Opportunities for students to develop safe and efficient application of tools, materials, machines, processes, and technical concepts;

(3) Planned activities designed to increase students' knowledge and skills related to energy and power, materials and processes, and information and communications technology;

(4) Courses totaling at least 4 credits in technology education of which at least one credit shall be offered in each of the following cluster areas:

a. Energy and power, including electricity, electronics, power mechanics, transportation, alternative energy, and energy conservation;

b. Process technology, including manufacturing technology, construction technology, wood technology, metal technology, medical technology, agricultural technology, and biotechnology; and

c. Communication and information technology, including drafting fundamentals, engineering drafting, architectural drafting, photography, printing, including desktop printing, and graphic arts and design; and

(5) Systematic instruction and activities designed to enable students to:

a. Understand the factors of production, including capital, labor, and management, in relation to industrial organization, systems and structure;

b. Perform manipulative tasks and develop skills in specific machine and tool operations;

c. Plan, design, and produce jigs, fixtures, and templates, as well as various products;

d. Think critically and constructively in supporting individual and societal needs for productivity and protection of the environment and our resources;

e. Develop leadership abilities required in a technological society; and

f. Analyze, research, and solve technological problems in a systematic and economically sound manner.

188-E:14 Pre-Engineering Technology Curriculum. –

I. The department of education shall facilitate the development and implementation of a pre-engineering technology curriculum in the public schools for students in grades 6 through 12 who are interested in careers in engineering, or allied engineering fields.

II. The state board of education shall adopt rules, pursuant to RSA 541-A, relative to course content, curricular requirements, and general procedures for implementing the pre-engineering technology curriculum. At a minimum, the curriculum shall include the following courses:

(a) Introduction to engineering design.

(b) Principles of engineering.

(c) Engineering design and development.

III. In developing and implementing a pre-engineering technology curriculum, the efforts of the department of education shall complement existing public and private actions, and shall include the pursuit of innovative public-private partnerships with businesses, nongovernmental organizations, academic institutions, and other appropriate groups. Such partnerships shall at a minimum consist of a 50/50 match of public and private funds. Teachers teaching in the pre-engineering technology curriculum, shall be certified to teach the course work as required in this curriculum.

IV. The department of education, in coordination with the regional vocational education centers, shall include in its biennial capital budget request, funding for the planning, construction, and renovation of equipment necessary for the operation of pre-engineering technology curriculum in the public schools for students in grades 6 through 12.

V. Public schools which implement the pre-engineering technology curriculum shall be responsible for maintaining the program with funding requests made through the budgetary cycle.

VI. The department of education shall develop a procedure for evaluating existing pre-engineering programs funded under this section and shall submit a report on the status of such programs to the speaker of the house of representatives and the president of the senate annually on December 1.

Source. 2002, 271:1, eff. July 1, 2002. 2008, 244:1-3, eff. Aug. 23, 2008.

Appendix D: Recommended Program Affiliates

New Hampshire Technology Education Association

The purpose of the NHTEA organization is to encourage and assist the development of Technology Education, vocational, and technical educational programs within the state. The organization will promote the professional growth of its members while emphasizing the importance of Technology Education for all children. The NHTEA will encourage research and its application in Technology Education activities.

Additional Information at: http://www.nhtea.org/ (accessed 12/2/2008)

New England Association of Technology Teachers

The Mission of the NEATT is to promote the development of the curriculum standards for Technology Education and the technological literacy of all students. Technology Education is a school discipline used to deliver an applied academic, hands-on approach to learning about the design and fabrication, problem solving and decision-making skills necessary for living in a technological world. To this end, the NEATT shall endeavor to provide a central exchange for the dissemination, discussion, and evaluation of professional issues in the field of Technology Education for the mutual benefit of our profession and the students we serve in the New England region.

Goals and Purpose of the NEATT

1.The NEATT recognizes and supports the "Technology for All Americans" project which has developed national Technology Education curriculum content standards from kindergarten through grade twelve.

2.The NEATT recognizes and supports the mission and purpose of the Technology Student Association (TSA) as the unique entity which addresses the Technology Education curriculum and its teachers.

3.The NEATT shall provide an annual fall Conference for its members. The conference shall rotate through the six New England States and will:

   a. provide for professional development for New England teachers interested in Technology Education.

   b. showcase, via the Technology Festival, outstanding Technology Education programs and activities in the New England Region.

   c. provide a showcase for vendors to demonstrate and market their products to New England Technology Education teachers.

4.The NEATT shall provide opportunities which support the development and offering of new and continuing education scholarships, including:

   a. an annual post-graduate professional scholarship to a member of NEATT to support formal study or related activities which enhance development in Technology Education areas.
   b. several annual scholarships to support academic preparation of promising Technology Education degree candidates.

ACTE - The Association for Career and Technical Education is the largest national education association dedicated to the advancement of education that prepares youth and adults for careers. Its mission is to provide educational leadership in developing a competitive workforce.

This mission is carried out through four purposes:

1. Professional Development--Encourage career development, professional involvement and leadership among members.
2. Program Improvement -- Foster excellence in career and technical education.
3. Policy Development -- Advocate national public policy to benefit career and technical education.
4. Marketing -- Promote career and technical to the general public.

ACTE offers many avenues to fulfill those purposes, including:

- Annual convention and trade show
- Year-round regional workshops
- Legislative Action Center
- Award-winning publications
- National awards program
- Professional resources
- Other membership services

About ACTE:

Founded in 1926, ACTE now has more than 38,000 members nationally who represent subject areas ranging from business education to health occupations education. (See Divisions for more details.) They are teachers, administrators, guidance counselors, university professors, state/local employees and students at middle, secondary and postsecondary educational levels.

Because the ultimate goal of ACTE is preparing students for the workplace, its members have strong ties with employers. ACTE sponsors the ACTE Business-Education Partnership, a group of business and education leaders that supports career and technical education programs.

For a more detailed breakdown of member demographics, see our media kit.

The association's national headquarters is based in Alexandria, Virginia, a suburb of Washington, D.C. Association policy is determined by a 21-member elected Board of Directors, including a president, past president and president-elect and 18 vice presidents representing the association's 13 divisions and five geographic regions. Members of the divisions and regions are appointed by the board to 12 standing committees that help determine policy. Day-to-day operations of the association are managed by a 45-member staff.

ACTE works full-time on legislative issues to make sure career and technical education programs are adequately funded... and that our members get all they need to make the most of their professional abilities.

Additional Information at: http://www.acteonline.org/ (accessed 12/2/2008)

ITEA

International Technology Education Association

International Technology Education Association

WHAT IS ITEA?

The International Technology Education Association is the largest professional educational association, principal voice, and information clearinghouse devoted to enhancing technology education through experiences in our schools (K-12). Its membership encompasses individuals and institutions throughout the world with the primary membership in North America.

ITEA's mission is to advance technological capabilities for all people and to nurture and promote the professionalism of those engaged in these pursuits.
ITEA seeks to meet the professional needs and interests of members as well as to improve public understanding of technology education and its contributions.
ITEA represents more than 40,000 technology educators in the U.S. alone who are developers, administrators, and university personnel in the field representing all levels of education.
ITEA corporate members are comprised of leading technology companies.
ITEA conducts various professional development programs and holds an Annual Conference -- the largest technology education showcase of exhibits and educational sessions in the world.
ITEA publishes *The Technology Teacher, Technology and Children, The Journal of Technology Education, The Technology Teacher* (the electronic version of TTT), and a variety of other publications and videos that lead the profession by providing teaching directions, instructional ideas, and networking opportunities.
ITEA has ten primary committees that coordinate all aspects of technology education and sponsor dozens of meetings, conferences, and exhibits each year.
ITEA sponsors an active honors and awards program that recognizes outstanding teachers and programs (K-12) from states, provinces, and countries that are affiliated with the Association.
ITEA also presents award certificates and supports other programs which recognize outstanding efforts in the technology teaching profession.
ITEA conducts a vigorous public policy program, frequently providing information to government, agencies, associations, and other special interest groups concerning technology education. The Association strives to provide an understanding of the importance of technology education to the future growth and well-being of all nations.

Additional Information at: http://www.iteaconnect.org/ (accessed 12/2/2008)

TECHNOLOGY STUDENT ASSOCIATION (TSA)

The committee strongly endorses the incorporation of the Technology Student Association (TSA) activities into the Technology Education Curriculum. This may be done any number of ways depending on the circumstances at the individual school. Some teachers are able to utilize TSA each day in the classroom while others find that it is best left as an after-school activity.
The mission of the New Hampshire Technology Student Association is to help students develop an understanding of all aspects of industry and technology and to aid them in the discovery and development of individual potential. NH-TSA has been organized to aid local chapters wishing to integrate TSA activities into their curricula. The specific goals of NH-TSA are:

1. To assist local associations in the growth and development of TSA.

2. To assist local associations in the development of leadership and citizenship in social, economic, scholastic and civic activities.

3. To increase the knowledge and understanding of our technological society.

4. To assist technology education students in exploration of occupational choices.

The objectives of all NH-TSA chapters are:

1. To develop leadership through group activities.

2. To explore the technologies of industry.

3. To promote high standards in scholarship.

4. To promote the application of safe practices throughout life.

5. To encourage students in critical thinking skills.

6. To provide career awareness and their requirements.

These goals and objectives may be achieved when technology lessons are followed by meaningful activities that allow students to solve real-life situations.

Additional Information concerning NHTSA at: http://nh-tsa.org/ (accessed 12/2/2008)
Additional Information concerning TSA at: http://www.tsaweb.org/ (accessed 12/2/2008)

The following TSA competitive events could provide some of these situations for your students:

High School Competitive Events	**Middle School Competitive Events**
Agriculture and Biotechnology Design	Agriculture and Biotechnology Challenge
Animatronics	Career Challenge
Architectural Model	Challenging Technology Issues
Career Comparisons	Chapter Team
Chapter Team	Communication Challenge
Computer-Aided Drafting, Architecture	Construction Challenge
Computer-Aided Drafting, Engineering	Cyberspace Pursuit
Construction Systems	Digital Photography Challenge
Cyberspace Pursuit	Dragster Design Challenge
Debating Technological Issues	Electrical Applications
Desktop Publishing	Electronic Game Challenge
Dragster Design	Environmental Challenge
Electronic Game Design	Flight Challenge
Electronic Research and Experimentation	Graphic Design Challenge
Engineering Design	Inventions and Innovations
Essays on Technology	Leadership Challenge
Extemporaneous Presentation	Manufacturing Challenge
Fashion Design	Medical Technology Challenge
Film	Prepared Speech
Flight Endurance	Problem Solving
Future Technology Teacher	Structural Challenge
Imaging Technology	System Control Technology
Manufacturing Prototype	Technical Design Challenge
Medical Technology	Technical Writing Challenge
Music Production	Technology Bowl Challenge
On-Demand Video	Technology Transfer Challenge
Prepared Presentation	Transportation Challenge
Promotional Graphics	TSA Cup: Marine Design Challenge
Radio Controlled Transportation	TSA Multimedia
Scientific and Technical Visualization	Video Challenge
Structural Engineering	
System Control Technology	
Technical Sketching and Application	
Technology Bowl	
Technology Dare	
Technology Problem Solving	
Transportation Modeling	

For additional information concerning the TSA Competitive Event Program, visit http://www.tsaweb.org/ (accessed 12/2/2008)

Appendix E: Task Force Members

Task Force Members for the 2001 Revision

I would like to personally thank Sarah Hale (copy editor) and the following people who have donated both their time and knowledge to create this curriculum guide. Through the work of many different people, this guide is a true reflection of the state of New Hampshire's beliefs regarding Technology Education. I hope that it will be used to prepare local curriculum that is diverse and challenging to our students. As the advancements of technology continue to flourish, so too should our curriculum guide.
Cynthia Allen, President
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