National Assessment Governing Board
Assessment Development Committee

November 30, 2012
9:30 am - 12:00 pm

AGENDA

9:30 – 9:40 am	Welcome, Introductions, and Agenda Overview *Alan Friedman, Chair*	
9:40 – 10:10 am	Plans for Reporting Information from the 2011 and 2012 Computer-Based NAEP Writing Administrations *Arnold Goldstein, NCES*	Attachment A
10:10 – 10:40 am	Update on NAEP Technology and Engineering Literacy (TEL) Assessment *William Ward, NCES*	Attachment B
10:40 am – 12:00 pm	**Closed Session** Review of Science Interactive Computer Tasks (ICTs) for the 2014 Pilot Test *Andrew Latham, ETS*	Attachment C Secure Materials Sent Under Separate Cover
Information Item	NAEP Item Review Schedule	Attachment D

NAEP Computer Based-Based Writing Assessment: Grade 4 Pilot

The 2011 NAEP Writing Framework specifies that,

> *"… In 2011 and beyond, the NAEP Writing Assessment at grades 8 and 12 will assess computer-based writing. For the purposes of the 2011 NAEP Writing Assessment, "computer-based writing" means that students compose and construct their responses using word processing software on a computer, with the option to use commonly available tools.*
>
> *At grade 4, a computer-based assessment was previously impractical because of time constraints for computer instruction, the unequal availability of technology in elementary schools, and elementary school students' current limited keyboarding proficiency. However, it is recommended that the assessment at grade 4 become computer-based during the tenure of the 2011 NAEP Writing Framework. …"*
>
> National Assessment of Educational Progress. (2011). *The Nation's Report Card: Writing 2002*. U.S. Department of Education, National Center for Education Statistics. Retrieved January 14, 2006, from http://www.nagb.org/content/nagb/assets/documents/publications/frameworks/writing-2011.pdf.

Under this guidance, NCES conducted a computer-based grade 4 pilot writing assessment in the spring of 2012. Over 13,000 students from more than 500 schools participated in the pilot.

Data collected during the pilot will provide critical guidance and insight into 4th grade students' ability to write on the computer, the development of computer based tasks and platforms, and the preparation, administration, and scoring of 4th grade writing computer-based assessments.

The presentation to the National Assessment Governing Board's Assessment Development Committee will discuss plans for reporting results from the grade 4 writing pilot and lessons learned.

While NCES is still considering the most effective way of providing this information to the public, we are considering a series of short reports that would consider the following topics:

- Do 4th grade students have the skills and abilities required to respond to writing prompts on a computer-based assessment?

- Are there any limitations to students' computer skills that have an effect on the quality of their responses, and can scorers be trained to score reliably, given these limitations?

- What have we learned in the design and development process that can inform future assessments?

- Are there opportunities to report more and different information about what students know and can do related to the data we can collect on students' actions on the computer?

Update on the NAEP Technology and Engineering Literacy (TEL) Assessment

1. Information and Outreach Activities

A number of materials have been developed to provide schools, parents, and students with information about the TEL assessment. A description of how and when these contacts take place will be reviewed. Outreach material developed specifically for the TEL assessment will be presented, including the materials described below.

Technology and Engineering Literacy Assessment Fact Sheet: this one page fact sheet was sent to schools in August and again in January. It provides specific information about the TEL assessment and answers questions such as what is TEL and why is TEL important for today's students. It also describes how TEL is assessed and what schools and students should expect.

NAEP In Your School – Grade 8 TEL: this one page document is sent to school principals in June. It gives a brief overview to the principal about what is involved in the TEL assessment and the main responsibilities of the NAEP state coordinator, principal, school coordinator, and NAEP field staff.

NAEP In Your School – School Coordinator Responsibilities – TEL: this one page document is sent in August to the school coordinator, who is the liaison for all NAEP activities at the school. This document provides detailed information specific to the responsibilities of the NAEP school coordinator. It also describes ways to promote NAEP with school staff and students.

TEL Video: NCES is currently developing a short, fully-animated video for the upcoming TEL assessment. It will aim to explain what Technology and Engineering Literacy actually means, what the NAEP TEL assessment is, what skills it will assess, and why it is important in today's educational landscape. While it will initially be used by school personnel and NAEP state coordinators as a resource for schools and students selected for the upcoming grade 8 pilot, it will also be geared towards the general public and will be housed on the NCES website.

TEL Tutorial: the TEL tutorial is the student's first experience with the TEL assessment and interactively shows the students the type of items they may encounter during the assessment. It also informs students how to use various tools in the program. The tutorial will be posted on the NAEP web site for the general public to view.

TEL is coming in 2013!: this postcard is sent in the January preassessment packet and points schools to the TEL page on the NAEP web site. It lists the various resources on the web site, including information about how TEL was created, a link to the tutorial and TEL video, and links to the student survey questions.

2. Update on TEL Development Work

A brief update will be presented to the ADC on November 30 on final TEL development work following the ADC's review of TEL tasks and items in August 2012.

NAEP
NATIONAL ASSESSMENT OF EDUCATIONAL PROGRESS

2013

GRADE 8 PILOT

Technology and Engineering Literacy Assessment

WHAT IS NAEP?

The National Assessment of Educational Progress (NAEP) is an essential measurement of student achievement in the United States.

- First administered in 1969, NAEP is the largest continuing and nationally representative assessment of what our nation's students know and can do in core subjects such as mathematics, reading, science, and writing.
- NAEP is administered by the National Center for Education Statistics within the Institute of Education Sciences of the U.S. Department of Education.
- NAEP monitors academic progress over time and reports on student achievement nationally.
- The results of NAEP are released as The Nation's Report Card.

To what extent can young people analyze the pros and cons of a proposal to develop a new source of energy? Can students use the Internet to find and summarize information in order to solve a problem? Do students understand how and why new technologies are developed to suit human needs and wants?

Technology and engineering have become critical components of 21st-century life. For generations students have been taught about technology and have been instructed on how to use various technological devices. However, there are currently no standardized, nationally representative assessments to provide evidence of what students know about technology and engineering; the role technology and engineering plays in our lives; and the extent to which students can use technologies and understand how engineers design and develop them.

The questions listed above are just a few examples of the types of questions the National Assessment of Educational Progress (NAEP) technology and engineering literacy (TEL) assessment will aim to answer. In 2013, a nationally representative sample of grade 8 students will participate in the TEL pilot. The results from this pilot will be used to prepare for the first-ever national TEL assessment of eighth-graders in 2014.

What is TEL?

The 2014 NAEP Technology and Engineering Literacy Framework broadly defines technology and engineering literacy as the capacity to use, understand, and evaluate technology as well as to understand technological principles and strategies needed to develop solutions and achieve goals.

This framework is the guide for the development of the TEL assessment and defines what students should know and be able to do with technology. The assessment is designed to assess three interconnected areas of technology and engineering literacy:

- Technology and Society
- Design and Systems
- Information and Communication Technology

The framework focuses on literacy as the level of knowledge and competencies about technology and engineering needed by all students and citizens to function in a technological society. The focus of the framework is not on whether students have the ability to engineer or produce technology in the professional sense. Therefore, TEL does not address technical knowledge of specific technologies nor types of engineering expertise taught in specialized courses to prepare some students for postsecondary engineering studies.

Why is TEL important for today's students?

The skills for technology and engineering literacy are increasingly being taught through a wide range of school coursework. This includes contemporary science, technology, engineering, and mathematics (STEM) education, as well as subjects such as social studies and language arts. These courses include instruction on the use of computers and information technology to complete school assignments, lessons that examine the role of technology in society, and information on engineering design. Information technologies are also essential tools in workplace and practical contexts.

Because of this growing importance of technology and engineering in the educational landscape, an assessment of technology and engineering literacy is an important addition to NAEP.

The TEL assessment opens the door to understanding what students know about technology and engineering, in the same way that NAEP already assesses their knowledge and capabilities in reading, mathematics, science, and other subjects.

How is TEL assessed?

Allowing students to demonstrate the wide range of knowledge and skills detailed in the three TEL assessment areas will require a departure from the typical assessment designs used in other NAEP subjects. Students will be asked to perform a variety of computer-based tasks to solve problems within scenarios that reflect realistic situations. These scenario-based tasks are an innovative component of NAEP. In addition to scenario-based tasks, TEL will also rely on short answer and multiple-choice questions to measure students' knowledge and skills.

Because technology and engineering literacy is not always attained in or confined to the classroom, the TEL assessment will be accompanied by a questionnaire component that aims to get a better understanding of students' opportunities to learn about technology and engineering both inside and outside the classroom.

What should schools expect?

The TEL pilot in 2013 will be administered by NAEP representatives who will work with school staff to organize the TEL assessment activities. NAEP representatives will bring necessary materials, including laptop computers and earbuds, to the school on assessment day. About 30 students in each school will be selected to participate, and the assessment will be administered in two sequential sessions of approximately 15 students each.

What should students expect?

Before the assessment begins, students will be shown a tutorial that will help them become familiar with the interface and how to use the program. It will take approximately 120 minutes for students to complete the assessment.

This publication was prepared for the National Assessment of Educational Progress by Hager Sharp
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NAEP
NATIONAL ASSESSMENT OF EDUCATIONAL PROGRESS

2013

GRADE 8 TECHNOLOGY AND ENGINEERING LITERACY ASSESSMENT

NAEP In Your School

WHAT IS NAEP?

The National Assessment of Educational Progress (NAEP) is an essential measurement of student achievement in the United States.

- First administered in 1969, NAEP is the largest continuing and nationally representative assessment of what our nation's students know and can do in core subjects such as mathematics, reading, science, and writing.
- The schools and students participating in NAEP represent other schools and students across the country.
- NAEP is considered the gold standard of assessments because of its high technical quality. From developing frameworks and questions to the reporting of results, NAEP represents the best thinking of assessment and content specialists, state education staff, and teachers from around the nation.
- NAEP monitors academic progress over time and reports on student achievement nationally.

NAEP will be administered to a sample of eighth-grade students in your school between January 28 and March 8, 2013. For the first time, eighth-grade students will participate in a computer-based technology and engineering literacy (TEL) pilot assessment. The results from this pilot will be used to inform the first-ever national TEL assessment of eighth-graders in 2014. This fact sheet will help you prepare your school and students for participation.

What is involved?

The TEL pilot will measure students' capacity to use, understand, and evaluate technology, as well as to understand technological principles and strategies. Students will spend about 120 minutes completing the assessment, which includes problem-solving tasks based on interactive scenarios reflecting realistic situations, and multiple-choice and short-answer questions. Students will also be asked to complete a questionnaire that aims to get a better understanding of their opportunities to learn about technology and engineering both inside and outside the classroom.

Principals will also be asked to complete a questionnaire. This questionnaire is being piloted to prepare for the collection of contextual information for future assessments. Additional information will be collected about how selected students with disabilities and English language learners (SD/ELL) might participate in the assessment.

NAEP staff members will bring all necessary materials, including laptop computers and earbuds, to the school on assessment day. Schools will only need to provide rooms, desks or tables, and electrical outlets; schools do not have to provide Internet access.

How many students are assessed?

Nationally, approximately 15,000 students will be assessed in the grade 8 TEL pilot. Thirty students at each school will be selected to participate. The pilot assessment will be administered in two sequential sessions of 15 students each.

For more information about NAEP, visit:
http://nces.ed.gov/nationsreportcard

Find us on:

Who is responsible for coordinating and administering NAEP?

Your NAEP State Coordinator, NAEP representatives, and school staff will work together to coordinate and administer the assessment.

A staff person in your school will need to be assigned to serve as the school coordinator, who will be the primary contact in the school for the assessment.

The NAEP State Coordinator works at your state Department of Education and will be responsible for:

- Working with schools to confirm the assessment date;
- Communicating with principals to convey the facts about NAEP and the importance of student participation;
- Providing schools with instructions for preparing a list of eligible students (if required) and information about notifying parents of participating students;
- Providing guidance for the inclusion of SD/ELL students; and
- Responding to questions from the school community throughout the assessment period.

NAEP representatives are employed by a U.S. Department of Education contractor to work directly with schools and will be responsible for:

- Selecting a random sample of students from the school list of eligible students;
- Sending preassessment materials to the school coordinator;
- Visiting the school coordinator shortly after the preassessment materials are received to finalize assessment arrangements;
- Bringing all assessment materials, including laptop computers, to the school on the scheduled day; and
- Conducting the assessment.

Each principal will be responsible for:

- Assigning a staff member to serve as school coordinator;
- Including the NAEP assessment date on the school calendar;
- Empowering the designated school coordinator to work with the NAEP representative and the NAEP State Coordinator to prepare for the assessment; and
- Informing school staff and students about NAEP and why student participation is critically important.

The school coordinator will be responsible for:

- Confirming with the NAEP State Coordinator that the suggested assessment date is convenient for the school;
- Providing NAEP with an electronic file of students in the selected grade, if requested;
- Registering for and using the MySchool website;
- Informing parents of the assessment (the NAEP State Coordinator will provide additional information about how this should be accomplished);
- Receiving the preassessment materials and making final preparations for the assessment;
- Meeting with the NAEP representative during the scheduled preassessment visit; and
- Ensuring that there is a plan with school staff to achieve high student participation in the assessment.

Detailed information about the school coordinator's responsibilities will be sent at the beginning of the school year.

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NATIONAL ASSESSMENT OF EDUCATIONAL PROGRESS

2013

GRADE 8 PILOT
TECHNOLOGY AND ENGINEERING LITERACY

NAEP In Your School

SCHOOL COORDINATOR RESPONSIBILITIES

TIMELINE

- **May - June 2012** Districts and schools are notified of their selection for NAEP 2013.
- **June 2012** Schools are notified of their assessment date. Dates should be entered on the school calendar.
- **August - September 2012** Schools receive a packet of materials from their NAEP State Coordinator with details on the school coordinator responsibilities.
- **September 2012** Schools register for the MySchool website and the school coordinator provides school information via this website.
- **October - November 2012** If requested, the school coordinator submits the list of eighth-grade students.
- **October 2012 - January 2013** School coordinator notifies parents/guardians about NAEP.
- **October 2012 - March 2013** School coordinator promotes NAEP with students and school staff.
- **Early January 2013** School coordinator receives the Preassessment Packet and instructions for preparing for the assessment. Prior to the preassessment visit with the NAEP representative, the school coordinator ensures that the worksheets for students with disabilities (SD) and English language learners (ELL) are completed.
- **January 2013** The NAEP representative and the school coordinator meet to review the Preassessment Packet and make final arrangements for the assessment day. School coordinator ensures that the school questionnaire is completed prior to assessment day.
- **January 28 - March 8, 2013** (Assessment Day) NAEP representatives administer the assessment.

For the first time, eighth-grade students will participate in a computer-based technology and engineering literacy (TEL) pilot assessment. As the school coordinator, you are the liaison for all NAEP assessment activities in your school. Thank you in advance for your help preparing for this important assessment!

In the fall, you will be responsible for the following:

Registering for and using the MySchool website.

The MySchool website provides information for schools about what to expect throughout the NAEP assessment process. It is used to collect information about your school and provides documents that you can download and customize for the NAEP assessment. Multiple school staff may register to access the site. To register for MySchool, go to www.mynaep.com and complete the registration form using the MySchool registration ID provided by your NAEP State Coordinator.

Completing and submitting school information.

Go to the MySchool website and click on "Provide School Information" to enter and submit information about your school. Providing up-to-date information about your school ensures that materials can be prepared for the assessment.

Providing the NAEP State Coordinator with a list of eighth-grade students (if requested).

NAEP requires a complete list of eighth-grade students so that a random sample of students can be selected to participate in the assessment and demographic information about these students can be collected. This list is usually submitted electronically and may be prepared by the school, district, or state. Your NAEP State Coordinator will inform you if and when you need to provide this list. Student names will always be kept confidential, and individual student responses or scores on NAEP are never reported.

Before the assessment date, you will be responsible for the following:

Receiving the Preassessment Packet and beginning final preparations for the assessment.

In early January, you will receive a Preassessment Packet that contains the list of students selected to participate as well as instructions, forms, and resources to help you prepare for NAEP. After you receive the packet, your school's NAEP representative will call you to confirm the date and time for the preassessment visit and to answer any questions about the materials. It is important that you review all the items and complete the necessary tasks described in the Preassessment Packet prior to the visit.

For more detailed information on preparing for NAEP 2013, visit: www.mynaep.com.

Find us on: YouTube

Informing parents/guardians of student participation.

By law, parents/guardians of students selected to participate in NAEP must be informed of their child's selection prior to the administration of the assessment. Parents must be informed that their child may be excused from participation for any reason, is not required to finish the assessment, and is not required to answer all test questions. Your NAEP State Coordinator will provide a sample Parent/Guardian Notification Letter and additional information about how this requirement should be fulfilled. These details, as well as electronic copies of the Parent/Guardian Notification Letter, will also be provided through the MySchool website. Parent notification should be completed prior to the preassessment visit. Parents may also visit http://nces.ed.gov/nationsreportcard/pdf/parents/2012469.pdf to download a brochure about NAEP.

Distributing and collecting worksheets and questionnaires from school staff.

You will be responsible for distributing, collecting, and reviewing a set of worksheets and questionnaires.

- Worksheets completed by school staff provide important information about how to assess SD and ELL students. Review the instructions for distributing and completing these worksheets and then share them with the staff person(s) most knowledgeable about how these students are tested on your state assessment. Collect and review the completed worksheets prior to the preassessment visit to ensure they are accurate.
- A school questionnaire for the principal will be provided during the visit and should be completed prior to the assessment.

Meeting with the NAEP representative during the scheduled preassessment visit.

In late January, you will meet with the NAEP representative to review the Preassessment Packet contents and go over logistics for the NAEP administration. During the meeting, you will review the list of selected students to verify that their demographic information is accurate and complete. Details for the assessment day will be finalized, including the time and location(s) of the assessment, how students and teachers will be notified, and which students will require accommodations. The NAEP representative will also verify that parents have been notified and will collect a copy of the parent notification letter during this visit.

Promoting the importance of NAEP with school staff.

Teachers are essential for motivating students to do their best on NAEP. Here are some suggestions on how to gain teacher support:

- Show the 5-minute NAEP video, *Introducing NAEP to Teachers*, at a faculty meeting. This video can be accessed at http://nces.ed.gov/nationsreportcard/about/schools.asp.
- Place copies of NAEP brochures and *Measure Up* newsletters in areas commonly used by your teachers.
- Inform teachers that released NAEP test questions and responses, which they can use in their classroom, are posted at http://nces.ed.gov/nationsreportcard/itmrlsx and that NAEP frameworks are available online at http://nagb.org/publications/frameworks.htm.

Promoting the importance of NAEP with students.

Students who are selected for NAEP will represent hundreds of students across the nation, so it is vital that these eighth-graders participate and do their best. Here are some suggestions on how to encourage students to do their best:

- Show the 5-minute video, *Introducing NAEP to Students*, to students selected to participate in NAEP. This video can be accessed at http://nces.ed.gov/nationsreportcard/students/.
- Speak with participating students prior to assessment day. Let them know why NAEP is important.
- Consider ways to thank students for their participation.

On the assessment date, you will be responsible for the following:

Ensuring that students attend the session.

Prior to the assessment start time, you will need to be available to ensure that students attend the sessions. You and/or teachers of the selected students are encouraged to remain in the room during the assessment. NAEP staff members will bring all necessary materials, including laptop computers and earbuds, to the school on assessment day. Schools will only need to provide rooms, desks or tables, and access to electrical outlets; schools do not have to provide Internet access. It is very important that attendance rates be as high as possible to avoid the need for makeup sessions. If attendance of sampled students is less than 90 percent, a makeup session will be needed, and the NAEP representative will schedule another date to administer the assessment to the students who were absent.

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2014 Abridged

Technology and Engineering Literacy Framework

FOR THE 2014 NATIONAL ASSESSMENT OF EDUCATIONAL PROGRESS

NATIONAL ASSESSMENT GOVERNING BOARD
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Introduction

We live in a world that is, to a large extent, shaped by technology: The computers and smart phones we use, the cars and planes we travel in, the homes and offices we inhabit; our food, clothes, entertainment, and medical care—all are created and driven by technology. Technology is also at the root of critical challenges we face as a society, such as the quest to link experts throughout the world, the search for sustainable energy, the ability to deal with global pandemics, and the development of environmentally friendly agriculture to feed a growing world population.

Until now, however, technology has not been a focus of instruction and assessment in our educational system, particularly at the elementary and secondary levels. Because of the growing importance of technology and engineering in the educational landscape, and to support America's ability to contribute to and compete in a global economy, the National Assessment Governing Board initiated development of the first national assessment in Technology and Engineering Literacy. Relating to national efforts in science, technology, engineering, and mathematics (STEM) fields, the NAEP Technology and Engineering Literacy assessment measures the "T" and "E" in STEM, augmenting longstanding NAEP assessments in science and mathematics.

NAEP Technology and Engineering Literacy (TEL) Assessment

The National Assessment of Educational Progress (NAEP), otherwise known as The Nation's Report Card, informs the public about the academic achievement of elementary and secondary students in the United States. Report cards communicate the findings of NAEP, a continuing and nationally representative measure of achievement in various subjects over time. For more than 35 years, NAEP has assessed achievement by testing samples of students most often in the fourth, eighth, and 12th grades. The results have become an important source of information on what U.S. students know and are able to do in a range of subject areas.

To create the new assessment, the National Assessment Governing Board sought a framework of technological literacy knowledge and skills that identifies the understandings and applications of technology principles that are important for all students. The framework defines "literacy" as the level of knowledge and competencies needed by all students and citizens. More than testing students for their ability to "do" engineering or produce technology, then, the assessment is designed to gauge how well students can apply their understanding of technology principles to real-life situations. At grade 4, for example, all students are expected to identify types of technologies in their world, design and test a simple model, explain how technologies can result in positive and negative effects, and use common technologies to achieve goals in school and in everyday life. By grade 12, students are expected to select and use a variety of tools and media to conduct research, evaluate how well a solution meets specified criteria, and develop a plan to address a complex global issue. To learn more, see a video clip ("Ecosystems") in the interactive framework of a sample scenario for grade 8 showing a student investigation of how organisms in an ecosystem are affected by a pollutant.

Technological literacy at grades 4, 8, and 12 is a pathway promoting further study and occupational pursuits. The Governing Board assembled a broad array of individuals and organizations to create a test of students' abilities to grasp and apply technology principles. The resulting framework is the culmination of a long, complex process that drew on the contributions of thousands of individuals and organizations including technology experts, engineers, teachers, researchers, business leaders, testing experts, and policymakers.

The 2014 NAEP Technology and Engineering Literacy Assessment will provide important results and information that can be used to determine whether our nation's students have the essential knowledge and skills needed in the technology and engineering areas. Policymakers, educators, and the public can use data from the initial assessments as tools for monitoring certain aspects of student achievement in technology and engineering literacy over time.

Definitions of Technology, Engineering, and Technology and Engineering Literacy

Any assessment of students' technology and engineering literacy must start with a clear idea of exactly what technology and engineering literacy means. That in turn requires clear definitions of technology and engineering.

Technology is any modification of the natural world done to fulfill human needs or desires.

This definition sees technology as encompassing the entire human-made world, from paper to the Internet. Technology also includes the entire infrastructure needed to design, manufacture, operate, and repair technological artifacts, from corporate headquarters and engineering schools to manufacturing plants and media outlets.

Engineering is a systematic and often iterative approach to designing objects, processes, and systems to meet human needs and wants.

This framework defines technology and engineering literacy in a broad fashion:

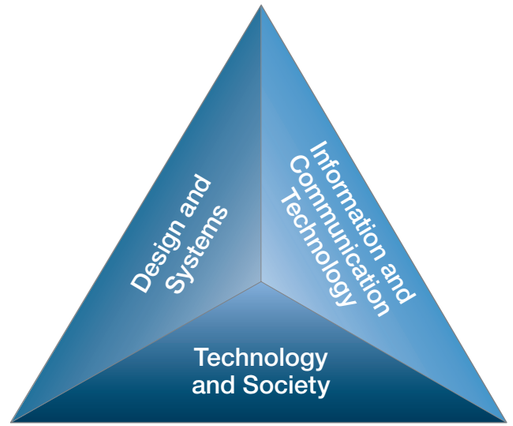
Technology and engineering literacy is the capacity to use, understand, and evaluate technology as well as to understand technological principles and strategies needed to develop solutions and achieve goals.

Thus—as with scientific, mathematical, and language literacy—technology and engineering literacy involves the mastery of a set of tools needed to participate intelligently and thoughtfully in society.

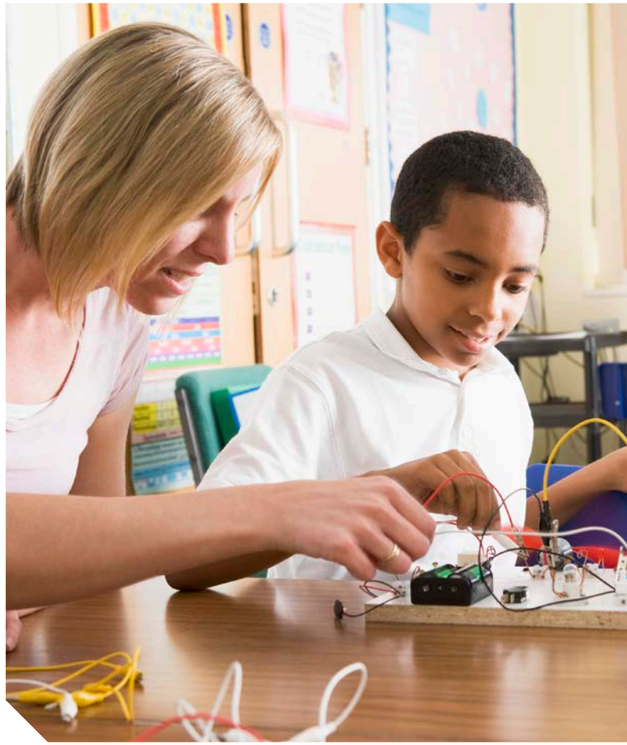
Three Areas of Technology and Engineering Literacy

Recognizing that it is not possible to assess every aspect of technology and engineering literacy, the TEL assessment framework targets the nature, processes, and uses of technology and engineering that are essential for 21st century citizens.

The assessment objectives are organized into three major areas: *Technology and Society; Design and Systems; and Information and Communication Technology (ICT)*. Each broad category is further broken down into discrete areas to be assessed.



The interconnected relationship among these three major assessment areas can be illustrated as a three-sided pyramid in which each side supports the other two. For example, in order to address an issue related to technology and society, such as clean water, energy needs, or information research, a person who is literate in technology and engineering must understand technological systems and the engineering design process and be able to use various information and communication technologies to research the problem and develop possible solutions.



Area 1. Technology and Society

deals with the effects that technology has on society and on the natural world and with the sorts of ethical questions that arise from those effects.

The four sub-areas in which students are assessed include:

A. *Interaction of Technology and Humans* concerns the ways in which society drives the improvement and creation of new technologies and how technologies serve society as well as change it. **Fourth-graders** are expected to know that people's needs and desires determine which technologies are developed or improved. For example, cell phones were invented, produced, and sold because people found it useful to be able to communicate with others wherever they were. **Eighth-graders** are expected to understand how technologies and societies co-evolve over significant periods of time. For example, the need to move goods and people across distances prompted the development of a long series of transportation systems from horses and wagons to cars and airplanes. **By 12th grade,** students are expected to realize that the interplay between culture and technology is dynamic, with some changes happening slowly and others very rapidly. They should be able to use various principles of technology design—such as the concepts of trade-offs and unintended consequences—to analyze complex issues at the interface of technology and society and to consider the implications of alternative solutions.

B. *Effects of Technology on the Natural World* is about the positive and negative ways that technologies affect the natural world. **Fourth-graders** are expected to know that sometimes technology can cause environmental harm. For example, litter from food packages and plastic forks and spoons discarded on city streets can travel through storm drains to rivers and oceans where they can harm or kill wildlife. **Eighth-graders** are expected to recognize that technology and engineering decisions often involve weighing competing priorities, so that there are no perfect solutions. For example, dams built to control floods and produce electricity have left wilderness areas under water and affected the ability of certain fish to spawn. **By 12th grade,** students should have had a variety of experiences in which technologies were used to reduce the environmental impacts of other technologies, such as the use of environmental monitoring equipment.

C. *Effects of Technology on the World of Information and Knowledge* focuses on the rapidly expanding and changing ways that information and communication technologies enable data to be stored, organized, and accessed and on how those changes bring about benefits and challenges for society. **Fourth-graders** should know that information technology provides access to vast amounts of information, that it can also be used to modify and display data, and that communication technologies make it possible to communicate across great distances using writing, voice, and images. **Eighth-graders** should be aware of the rapid progress in development of ICT, should know how information technologies can be used to analyze, display, and communicate data, and should be able to collaborate with other students to develop and modify a knowledge product. **By 12th grade,** students should have a full grasp of the types of data, expertise, and knowledge available online and should be aware of intelligent information technologies and the uses of simulation and modeling.

D. *Ethics, Equity, and Responsibility* concerns the profound effects that technologies have on people, how those effects can widen or narrow disparities, and the responsibility that people have for the societal consequences of their technological decisions. **Fourth-graders** should recognize that tools and machines can be helpful or harmful. For example, cars are very helpful for going from one place to another quickly, but their use can lead to accidents in which people are seriously injured. **Eighth-graders** should be able to recognize that the potential for misusing technologies always exists and that the possible consequences of such misuse must be taken into account when making decisions. **By 12th grade**, students should be able to take into account both intended and unintended consequences in making technological decisions.

Area 2. Design and Systems covers the nature of technology, the engineering design process by which technologies are developed, and basic principles of dealing with everyday technologies, including maintenance and troubleshooting.

The four sub-areas in which students are assessed include:

A. *Nature of Technology* offers a broad definition of technology as consisting of all the products, processes, and systems created by people to meet human needs and desires. **Fourth-graders** are expected to distinguish natural and human-made materials, to be familiar with simple tools, and to recognize the vast array of technologies around them. **Eighth-graders** should know how technologies are created through invention and innovation, should recognize that sometimes a technology developed for one purpose is later adapted to other purposes, and should understand that technologies are constrained by natural laws. **By 12th grade,** students should have an in-depth understanding of the ways in which technology coevolves with science, mathematics, and other fields; should be able to apply the concept of trade-offs to resolve competing values; and should be able to identify the most important resources needed to carry out a task.

B. *Engineering Design* is a systematic approach to creating solutions to technological problems and finding ways to meet people's needs and desires. **Fourth-graders** should know that engineering design is a purposeful method of solving problems and achieving results. **Eighth-graders** should be able to carry out a full engineering design process to solve a problem of moderate difficulty. **By 12th grade,** students should be able to meet a complex challenge, weigh alternative solutions, and use the concept of trade-offs to balance competing values.

C. *Systems Thinking* is a way of thinking about devices and situations so as to better understand interactions among components, root causes of problems, and the consequences of various solutions. **Fourth-graders** should know that a system is a collection of interacting parts that make up a whole, that systems require energy, and that systems can be either living or non-living. **Eighth-graders** should be able to analyze a technological system in terms of goals, inputs, processes, outputs, feedback, and control, and they should be able to trace the life cycle of a product from raw materials to eventual disposal. **By 12th grade,** students should be aware that technological systems are the product of goal-directed designs and that the building blocks of any technology consist of systems that are embedded within larger technological, social, and environmental systems. They should also be aware that the stability of a system is influenced by all of its components, especially those in a feedback loop.

D. *Maintenance and Troubleshooting* is the set of methods used to prevent technological devices and systems from breaking down and to diagnose and fix them when they fail. **Fourth-graders** should know that it is important to care for tools and machines so they can be used when they are needed. Students should also know that if something does not work as expected, it is possible to find out what the problem is in order to decide if the item should be replaced or how to fix it. **Eighth-graders** should be familiar with the concept of maintenance and should understand that failure to maintain a device can lead to a malfunction. They should also be able to carry out troubleshooting, at least in simple situations. **By 12th grade,** students should know that many devices are designed to operate with high efficiency only if they are checked periodically and properly maintained. They should also have developed the capability to troubleshoot devices and systems, including those that they may have little experience with.

Area 3. Information and Communication Technology includes computers and software learning tools, networking systems and protocols, hand-held digital devices, and other technologies for accessing, creating, and communicating information and for facilitating creative expression.

The five sub-areas in which students are assessed include:

A. *Construction and Exchange of Ideas and Solutions* concerns an essential set of skills needed for using ICT and media to communicate ideas and collaborate with others. **Fourth-graders** should understand what is expected from members working as part of a team and should realize that teams are better than individuals at solving many kinds of problems. **Eighth-graders** should know that communicating always involves understanding the audience—the people for whom the message is intended. They should also be able to use feedback from others, and provide constructive criticism. **By 12th grade**, students are expected to have developed a number of effective strategies for collaborating with others and improving their teamwork. They should be able to synthesize information from different sources and communicate with multiple audiences.

B. *Information Research* includes the capability to employ technologies and media to find, evaluate, analyze, organize, and synthesize information from different sources. **Fourth-graders** should be aware of a number of digital and network tools that can be used for finding information, and they should be able to use these tools to collect, organize, and display data in response to specific questions and to help solve problems. **Eighth-graders** should be aware of digital and network tools and be able to use them efficiently. They should be aware that some of the information they retrieve may be distorted, exaggerated, or otherwise misrepresented, and they should be able to identify cases where the information is suspect. **By 12th grade**, students should be able to use advanced search methods and select the best digital tools and resources for various purposes. They should also be able to evaluate information for timeliness and accuracy.

C. *Investigation of Problems* concerns the use of information and communication technology to define and solve problems in core school subjects and in practical situations. **Fourth-graders** should be able to use a variety of information and communication technologies to investigate a local or otherwise familiar issue and to generate, present, and advocate

for possible solutions. **Eighth-graders** should be able to use digital tools to identify and research a global issue and to identify and compare different possible solutions. **By 12th grade,** students should be able to use digital tools to research global issues and to fully investigate the pros and cons of different approaches. They should be able to design and conduct complex investigations in various subject areas using a variety of digital tools to collect, analyze, and display information and be able to explain the rationale for the approaches they used in designing the investigation as well as the implications of the results.

D. *Acknowledgement of Ideas and Information* involves respect for the intellectual property of others and knowledge of how to credit others' contributions appropriately, paying special attention to the misuse of information enabled by rapid technological advances. **Fourth-graders** should understand that it is permissible to use others' ideas as long as appropriate credit is given. They should also know that copyrighted materials cannot be shared freely. **Eighth-graders** should be aware of general principles concerning the use of other people's ideas and know that these principles are the basis for such things as school rules and federal laws governing such use. They should know about the limits of fair use of verbatim quotes and how to cite sources. **By 12th grade**, students should understand the fundamental reasons for intellectual property laws and should know acceptable practices for citing sources when incorporating ideas, quotes, and images into their own work.

E. *Selection and Use of Digital Tools* includes both knowledge and skills for choosing appropriate tools and using a wide variety of electronic devices, including networked computing and communication technology and media. **Fourth-graders** should know that different digital tools have different purposes and they should also be able to use a variety of digital tools that are appropriate for their age level. **Eighth-graders** should be familiar with different types of digital tools and be able to move easily from one type of tool to another—for example, creating a document or image with one tool and then using a second tool to communicate the result to someone at a distant location. **By 12th grade,** students should be competent in the use of a broad variety of digital tools and be able to explain why some tools are more effective than others that were designed to serve the same purpose, based on the features of the individual tools.

Although these elements are central to the design of the NAEP Technology and Engineering Literacy Assessment, they are not sufficient to describe the kinds of reasoning to be expected from students, the context or subject matter that will be used to construct test items, or the overall shape of the entire assessment. The assessment targets and the sub-areas within each describing what students should be able to do foreshadow the cross-cutting practices—ways of thinking and reasoning—for which the TEL is designed.

Practices and Contexts for Technology and Engineering Literacy

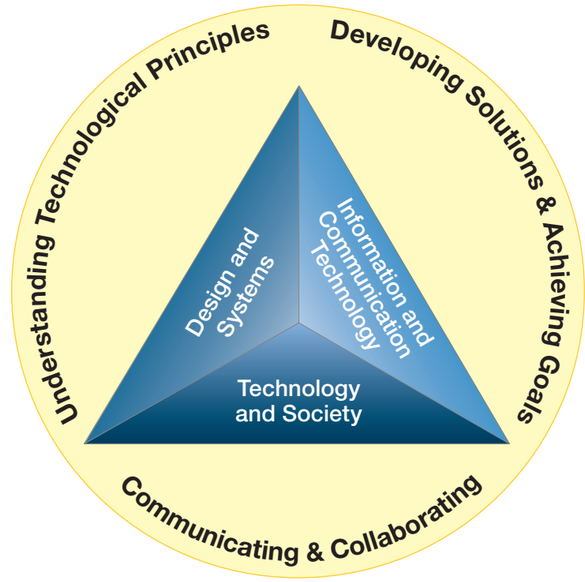
In all three areas of technology and engineering literacy, students are expected to be able to apply particular ways of thinking and reasoning when approaching a problem, and they are expected to do so in various contexts.

The practices can be grouped into three broad categories: *Understanding Technological Principles; Developing Solutions and Achieving Goals; and Communicating and Collaborating.*

Understanding Technological Principles focuses on students' knowledge and understanding of technology and their capability to think and reason with that knowledge.

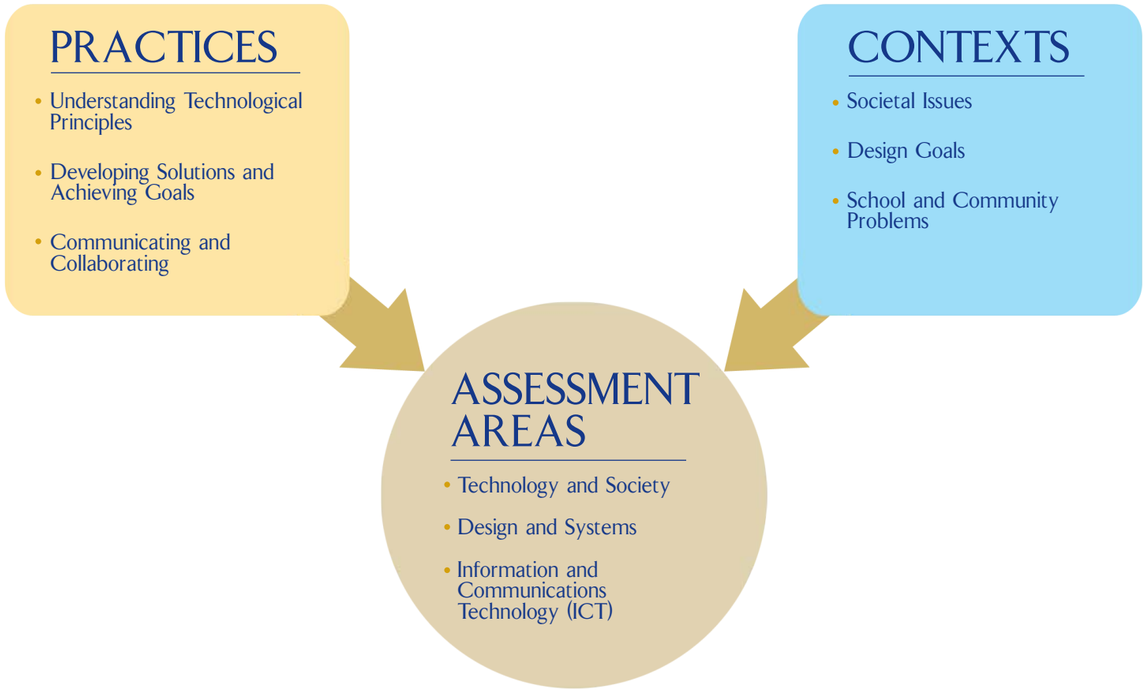
Developing Solutions and Achieving Goals refers to students' systematic application of technological knowledge, tools, and skills to address problems and achieve goals presented in societal, design, curriculum, and realistic contexts.

Communicating and Collaborating centers on students' capabilities to use contemporary technologies to communicate for a variety of purposes and in a variety of ways, working individually or in teams.



These practices are applied across all three major assessment areas. For example, communicating effectively and collaborating with others are necessary skills for understanding the effects of technology on the natural world, designing an engineering solution to a technological problem, and achieving a goal using information and communication technologies.

As crucial to the assessment as the practices are the **contexts**—the situations and types of problems in which assessment tasks and items will be set.



Elements of the NAEP Technology and Engineering Literacy Assessment

The practices expected of students are general, cross-cutting reasoning processes that students must use in order to show that they understand and can use their technological knowledge and skills. The contexts in which technology and engineering literacy tasks and items appear will include typical issues, problems, and goals that students might encounter in school or practical situations. Together, the assessment targets, practices, and contexts provide a structure for the generation of tasks and items.

Below are examples of the types of tasks and items that result when these three elements are combined. The table shows how the three practices—Understanding Technological Principles, Developing Solutions and Achieving Goals, and Communicating and Collaborating—can be used to classify the general types of thinking and reasoning intended by the assessment targets in the three major assessment areas of Technology and Society, Design and Systems, and Information and Communication Technology.

Classification of types of assessment targets in the three major assessment areas according to the practices for technology and engineering literacy

	Technology and Society	Design and Systems	Information and Communication Technology
Understanding Technological Principles	**Analyze** advantages and disadvantages of an existing technology **Explain** costs and benefits **Compare** effects of two technologies on individuals **Propose** solutions and alternatives **Predict** consequences of a technology **Select** among alternatives	**Describe** features of a system or process **Identify** examples of a system or process **Explain** the properties of different materials that determine which is suitable to use for a given application or product **Analyze** a need **Classify** the elements of a system	**Describe** features and functions of ICT tools **Explain** how parts of a whole interact **Analyze** and compare relevant features **Critique** a process or outcome **Evaluate** examples of effective resolution of opposing points of view **Justify** tool choice for a given purpose
Developing Solutions and Achieving Goals	**Select** appropriate technology to solve a societal problem **Develop** a plan to investigate an issue **Gather and Organize** data and information **Analyze and Compare** advantages and disadvantages of a proposed solution **Investigate** environmental and economic impacts of a proposed solution **Evaluate** trade-offs and impacts of a proposed solution	**Design and Build** a product using appropriate processes and materials **Develop** forecasting techniques **Construct and Test** a model or prototype **Produce** an alternative design or product **Evaluate** trade-offs **Determine** how to meet a need by choosing resources required to meet or satisfy that need **Plan** for durability **Troubleshoot** malfunctions	**Select and Use** appropriate tools to achieve a goal **Search** media and digital resources **Evaluate** credibility and solutions **Propose and Implement** strategies **Predict** outcomes of a proposed approach **Plan** research and presentations **Organize** data and information **Transform** from one representational form to another **Conduct** experiments using digital tools and simulations
Communicating and Collaborating	**Present** innovative, sustainable solutions **Represent** alternative analyses and solutions **Display** positive and negative consequences using data and media **Compose** a multimedia presentation **Produce** an accurate timeline of a technological development **Delegate** team assignments **Exchange** data and information with virtual peers and experts	**Display** design ideas using models and blueprints **Use** a variety of media and formats to communicate data, information, and ideas **Exhibit** design of a prototype **Represent** data in graphs, tables, and models **Organize, Monitor, and Evaluate** the effectiveness of design teams **Request** input from virtual experts and peers **Provide and Integrate** feedback	**Plan** delegation of tasks among team members **Provide and Integrate** feedback from virtual peers and experts to make changes in a presentation **Critique** presentations **Express** historical issues in a multimedia presentation **Argue** from an opposing point of view **Explain** to a specified audience how something works **Address** multiple audiences **Synthesize** data and points of view

Content and Design

To identify what students know and can do with regard to technology and engineering, the NAEP TEL framework calls for the assessment to be totally computer-based. In 2014 the NAEP TEL assessment will be conducted at grade 8 with a national sample of students in public and private schools. The assessment will include tasks and items sampled from the domain of technology and engineering literacy achievement identified by the intersection of the three major areas of technology and engineering literacy and the cross-cutting practices at grades 4, 8, and 12—grades that will participate in the TEL assessment in future years.

Allowing students to demonstrate the wide range of knowledge and skills detailed in the NAEP Technology and Engineering Literacy Assessment targets will require a departure from the typical assessment designs used in other NAEP content areas. Thus students will be asked to perform a variety of actions using a diverse set of tools in the process of solving problems and meeting goals within rich, complex scenarios that reflect realistic situations. Consequently, this assessment will rely primarily on scenario-based assessment sets that test students through their interaction with multimedia tasks that include conventional item types, such as selected response items, and also monitor student actions as they manipulate components of the systems and models that are presented as part of the task.

Because of their capability to replicate authentic situations examinees may encounter in their lives, scenarios have the potential to provide a level of authenticity other types of assessment tasks cannot provide. At the same time, the choice to use these complex tasks reduces the number of measures that can be included in any one test and causes many of the measures to be interdependent because they are related to the same scenario. To counteract this interdependency and ensure reliability, the NAEP assessment of technology and engineering literacy will also include sets of discrete items that produce independent measures.

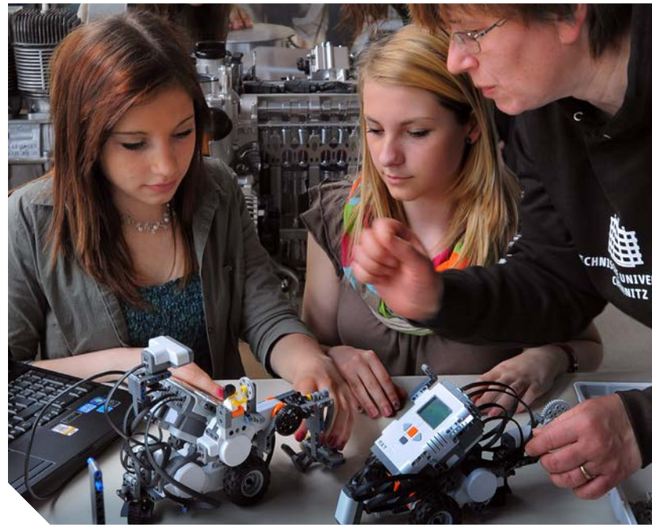
Scenario-Based Assessment Sets

There will be two types of scenario-based assessment sets, one long and one short. The long scenarios will take students approximately 25 minutes. The short scenarios will take students about 12 to 15 minutes to respond. The two types of scenarios have common characteristics, but they differ in the complexity of the scenario and the number of embedded assessment tasks and items to which a student is asked to respond.

A set of sample video clips demonstrates the types of interactivity and functionality of tools that students might be expected to use as they respond to short and long scenarios that will be developed for the Technology and Engineering Literacy Assessment.

Discrete Item Sets

Discrete item sets will include conventional selected response items and short constructed response items. The discrete item sets will comprise approximately 10-15 stand-alone items in either selected or constructed response format to be completed within a 25-minute block. Each discrete item would provide a stimulus that presents enough information to answer the particular question posed in the stem of the item. Items in discrete sets will be selected response items (e.g., multiple choice) or short constructed response items in which a student writes a text-based response.



Background Variables

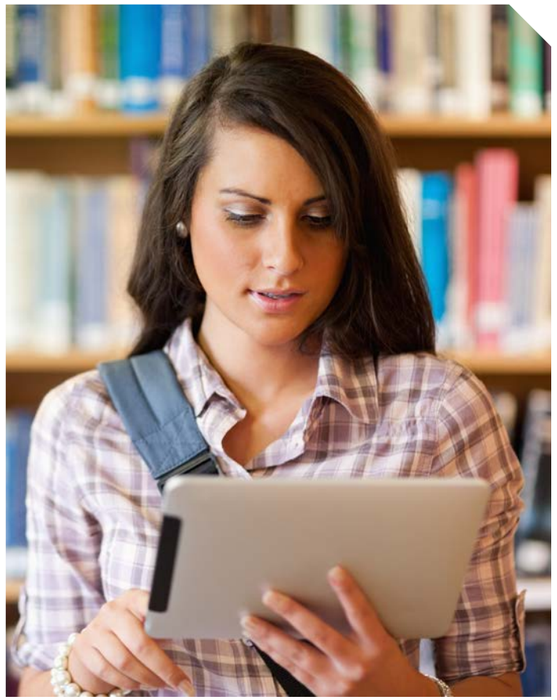
Background data on students, teachers, and schools are needed to fulfill the statutory requirement that NAEP include information, whenever feasible, for various subgroups of students at the national level including gender, race/ethnicity, eligibility for free or reduced-price lunch, English language learners, and students with disabilities. Therefore, students, teachers, and school administrators participating in NAEP are asked to respond to questionnaires designed to gather demographic information. Information is also gathered from non-NAEP sources, such as state, district, or school records. For the 2014 NAEP Technology and Engineering Literacy Assessment, only student and school information will be collected as many students will not have taken a separate course in technology and engineering literacy taught by a specific teacher.

In addition to demographic information, background questionnaires include questions about variables related to opportunities to learn and achievement in technology and engineering literacy. The variables are selected to be of topical interest, to be timely, and to be directly related to academic achievement and current trends and issues in technology and engineering literacy. Questions do not solicit information about personal topics or information irrelevant to the collection of data on technology and engineering literacy achievement.

Achievement Levels

The Governing Board uses student achievement levels of *Basic, Proficient,* and *Advanced* to report results of NAEP assessments. The achievement levels represent an informed judgment of "how good is good enough" in the various subjects that are assessed. Technology and Engineering Literacy achievement levels specific to the 2014 NAEP Technology and Engineering Literacy Framework will be developed to elaborate the generic policy definitions of *Basic, Proficient,* and *Advanced* achievement. Preliminary achievement level definitions have been developed for each of the three areas to be reported separately in the assessment and they will be used to guide item development and initial stages of standard setting for the 2014 NAEP Technology and Engineering Literacy Assessment.

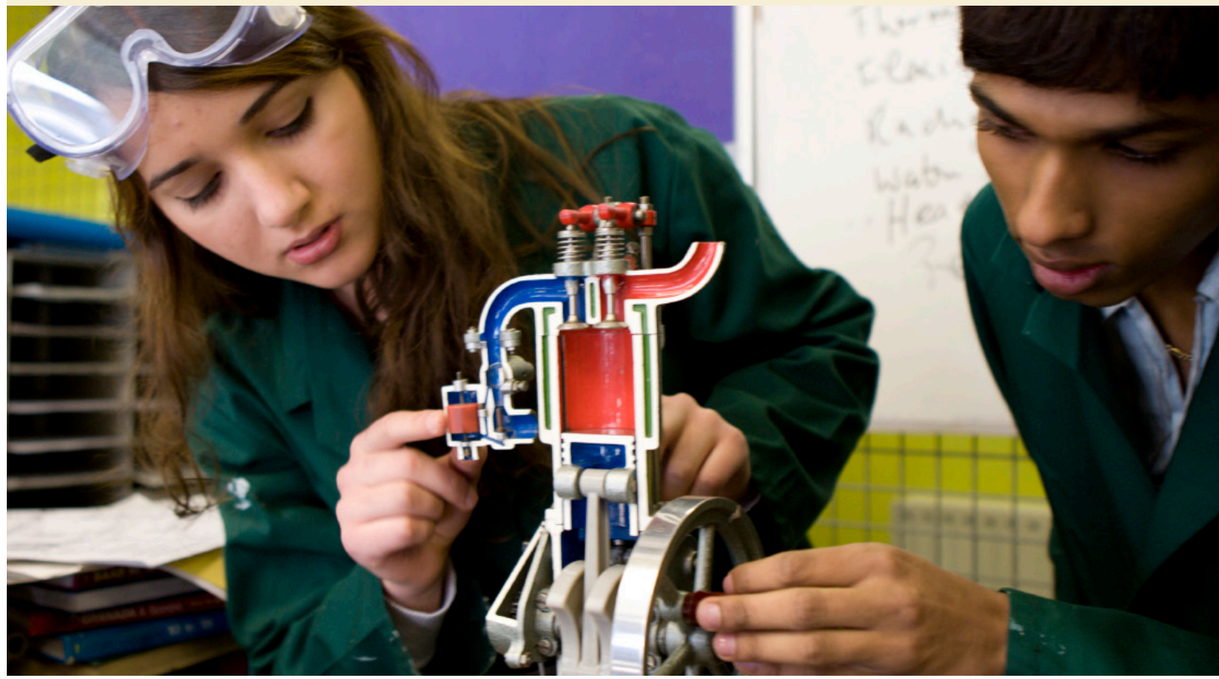
The preliminary achievement level definitions will be revised when actual student responses have been collected and analyzed. The Governing Board will convene panels of experts to examine the preliminary achievement level definitions and to recommend final achievement level definitions for each grade level.



Conclusion

For generations students have been taught about technology and have been instructed in the use of various technological devices, but there has been no way to know exactly what students understand about technologies and their effective uses. The exploding growth in the world of technology led the Governing Board to sponsor the development of a framework for a National Assessment of Technology and Engineering Literacy. The Governing Board hopes that this TEL Framework will serve as a significant national measure of what students know and can do in technology and engineering, and support improvements in student achievement.

To view the complete Technology and Engineering Literacy Framework for the 2014 NAEP, or to view an interactive version of the framework, please visit http://nagb.org/publications/frameworks.htm or call us at 202.357.6938.



The National Assessment Governing Board is an independent, bipartisan board whose members include governors, state legislators, local and state school officials, educators, business representatives, and members of the general public. Congress created the 26-member Governing Board in 1988 to set policy for the National Assessment of Educational Progress (NAEP).

For more information on the National Assessment Governing Board, please visit www.nagb.org or call us at 202-357-6938.

Science Interactive Computer Tasks

Development work has begun on the 2015 Science Interactive Computer Tasks for grades 4, 8 and 12. A subset of the tasks will be administered and reported in 2015.

Similar to the NAEP Technology and Engineering Literacy (TEL) assessment, the Science Interactive Computer Tasks will be developed using an Evidence Centered Design (ECD) model. ECD draws from research in cognitive science, psychometrics, and other fields to link together what will be measured (the student model), the evidence that will be used to make inferences (the evidence model), and the tasks that be will used to collect this evidence (the task model).

During the November 2012 meeting, the Assessment Development Committee (ADC) will review Interactive Computer Tasks currently under development. The session will be divided into three sections shown below.

1. Overview of the Science Interactive Computer Tasks Reporting Goals

The first section will begin with a description of the reporting goals for the tasks and how the tasks will be used in conjunction with Hands-on Tasks and Discrete items to provide the richest possible measurement of students' science knowledge, skills, and abilities.

2. Orientation to Design Patterns and Task Templates

The second section will describe how the ECD model is used to translate the NAEP Science Framework into a set of design patterns and task templates that will both guide and document the task development process.

3. Review of Draft Task Outlines and Storyboards

The third section will present task outlines for the first set of tasks under development. Some of these tasks will include draft storyboards with artwork to help the ADC see the flow and look/feel of the tasks. Several aspects of the task designs will be highlighted during this period, including how the elements of the designs link back to the design patterns and task templates, documenting the underlying validity argument for each task. The Committee will be asked to provide feedback on all task outlines.

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Institute of Education Sciences

Assessment Development Committee
Item Review Schedule
November 2012 – August 2013

(Updated 10/30/12)

Review Package to Board	Board Comments to NCES	Background/ Cognitive	Review Task	Approx Number Items	Status
11/26/12	12/5/12	Cognitive	2015 Pilot Science Interactive Computer Tasks (SICTs) (4, 8, 12)	8 task outlines	Review on Nov. 30
12/21/12	1/17/13	Cognitive	2015 Pilot Science (4,8,12)	310 items	
1/11/13	1/22/13	Cognitive	2015 Pilot SICTs (4, 8, 12)	8 task outlines 8 alpha versions*	
2/14/13 *(Tentative/TBD)*	3/7/13	Background	2015 Science (4, 8, 12)	169 items	
2/11/13	2/25/13	Cognitive	2017 Reading (12)	TBD Reading Passages	
2/25/13	3/5/13	Cognitive	2015 Pilot SICTs (4, 8, 12)	8 task outlines 8 alpha versions	
3/28/13	4/18/13	Cognitive	2015 Pilot SICTs (4, 8, 12)	3 task outlines 8 alpha versions 3 beta versions	
4/5 (*Tentative/TBD)*	TBD	Background	2014 TEL	TBD	
5/02/13	5/23/13	Cognitive	2015 Pilot SICTs (4, 8, 12)	3 alpha versions 8 beta versions	
6/13/13	7/5/13	Cognitive	2015 Pilot SICTs (4, 8, 12)	3 alpha versions 8 beta versions	
7/25/13	8/8/13	Cognitive	2015 Pilot SICTs (4, 8, 12)	8 beta versions	

*Alpha and beta versions are the first- and second-draft versions of the rendered task, respectively.