Technical Q&A for 2018 Technology and Engineering Literacy (TEL) Assessment at Grade 8

A. Assessment design and administration

1. **What is "technology and engineering literacy"?**
   The framework that guided the TEL assessment focused on "literacy" as the level of technological and engineering skills and knowledge needed by all students, not just those pursuing careers in the fields of science, technology, engineering, and mathematics (STEM). The framework 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."

2. **What is the relationship between technology and engineering and science?**
   While technology, engineering, and science are closely linked, they are distinct from one another. To guide the development of an assessment of technology and engineering literacy, the TEL framework clearly distinguishes technology, engineering, and science. The framework defines the three terms as follows:

   - ***Technology*** is any modification of the natural or designed world done to fulfill human needs or desires.
   - ***Engineering*** is a systematic and often iterative approach to designing objects, processes, and systems to meet human needs and wants.
   - ***Science*** is the investigation of the natural world.

3. **What content was assessed in the NAEP TEL assessment in 2018?**
   The TEL framework organizes the assessment objectives into the following three major assessment areas:

   - ***Technology and Society*** deals with the effects that technology has on society and the environment as well as the ethical questions raised by those effects.
   - ***Design and Systems*** focuses on the nature of technology and the processes used to develop technologies, as well as basic principles for dealing with everyday technologies.
   - ***Information and Communication Technology*** covers the software and systems used for accessing, creating, and communicating information, and for facilitating creative expression.

When asked to solve problems within the content areas, students were expected to apply certain types of thinking and reasoning categorized by the TEL framework into the following three practices:

- ***Understanding Technological Principles*** focuses on how well students are able to make use of their knowledge about technology.
- ***Developing Solutions and Achieving Goals*** refers to students' systematic use of technological knowledge, tools, and skills to solve problems and achieve goals presented in realistic contexts.
- ***Communicating and Collaborating*** concerns how well students are able to use contemporary technologies to communicate for a variety of purposes and in a variety of ways, working individually or in teams, with peers and experts.

4. What is the testing platform for the TEL assessment in 2018?

As computers and digital tools play an increasingly important role in today's classrooms, the NAEP is advancing with digitally based assessments (DBAs) to measure what the nation's students know and can do. NAEP DBAs enable students to demonstrate a broad range of skills in problem solving and analytical thinking which are not easily measured by paper-and-pencil assessments.

Same as the first TEL assessment in 2014, the 2018 TEL assessment was a fully digital-based assessment administered to students on laptops provided by the NAEP program. Through engagement with multimedia scenario-based tasks, students were asked to solve technology and engineering problems in a variety of real-world contexts. In addition to scenario-based tasks, the TEL assessment also included different types of discrete questions as another way to measure students' knowledge and skills.

5. What was the administration window for the 2018 TEL assessment?

The assessment window was from January to March in 2018.

6. How many "assembly units" were there for the 2018 TEL assessment? How many blocks were in each assembly unit?

There were 16 assembly units (AU) in the 2018 TEL assessment. Among the 16 AUs, 11 of them comprise a mixture of discrete blocks and scenario-based tasks (SBT); four of them consist of a single 30 minute SBT, and one AU consists of a single 30-minute block of discrete items. Each SBT and discrete block is separately timed and may vary in length. However, the timing for each AU is 30 minutes. Each student took 2 AUs. In total, there were 77 discrete questions and 15 SBTs across the 16 AUs.

7. What was the distribution of student time by SBTs and discrete items in the 2018 TEL assessment?

TEL item type	Percentage of assessment time
Scenario-based task	63%
Discrete	37%

NOTE: Percentage of time is an approximation based on average response times for discrete items.

8. What was the item counts distribution by item types and by content area and practice?

TEL item types	Item count	Percentage of assessment item
Constructed-response	85	47%
Selected-response	94	53%
Scenario-based task	102	57%
Discrete	77	43%

TEL Content Areas	Item count	Percentage of assessment item
Technology and Society	62	35%
Design and Systems	46	26%
Information Communication Technology	71	40%
Total	179	100%

TEL Practices	Item count	Percentage of assessment item
Understanding Technological Principles	37	21%
Developing Solutions and Achieving Goals	104	58%
Communicating and Collaborating	38	21%
Total	179	100%

NOTE: Detail may not sum to totals because of rounding.

B. Participation and demographic information

9. How many schools and students participated in the 2018 TEL assessment?

The number of participating schools and the number of assessed students are shown in the table below.

TEL Participation Summary	
Number of schools participating	600
Number of students assessed	15,400

NOTE: The number of schools is rounded to the nearest ten and the number of students is rounded to the nearest hundred.

10. What were the school and student participation rates in the 2018 TEL assessment?

School and student participation rates at grade 8 in NAEP technology and engineering literacy (TEL), by type of school: 2018

	School participation			Student participation	
Type of school	Student-weighted percent	School-weighted percent	Number of schools participating	Student-weighted percent	Number of students assessed
Nation	**86**	**69**	**600**	**93**	**15,400**
Public	89	85	530	93	14,100
Private	58	45	70	93	1,300

NOTE: The national totals for schools include Department of Defense Education Activity (overseas and domestic schools) and Bureau of Indian Education schools, which are not included in either the public or private totals. The national totals for students include students in these schools. The number of schools is rounded to the nearest ten. The number of students is rounded to the nearest hundred.

11. What were the exclusion and accommodation rates for the 2018 TEL assessment?

Percentage of eighth-grade students identified as students with disabilities (SD) and/or English language learners (ELL) excluded and assessed in NAEP technology and engineering literacy (TEL), as a percentage of all students, by SD/ELL category: 2018

	Percentage of all students				
SD/ELL category	Identified	Excluded	Assessed	Assessed without accommodations	Assessed with accommodations
SD and/or ELL	18	2	17	6	11
SD	13	1	12	3	9
ELL	6	1	6	3	3

NOTE: Students identified as both SD and ELL were counted only once under the combined SD and/or ELL category, but were counted separately under the SD and ELL categories. Detail may not sum to totals because of rounding.

12. When calculated as a percentage of the total sample, exclusion and accommodation rates seem small. However, what do the rates look like when the excluded and accommodated rates are calculated as a percentage of just the students identified as students with disabilities (SD), English language learners (ELL), or both?

Percentage of eighth-grade students identified as students with disabilities (SD) and/or English language learners (ELL) excluded and assessed in NAEP technology and engineering literacy (TEL), as a percentage of identified SD and/or ELL students, by SD/ELL category: 2018

	Percentage of identified SD and/or ELL students			
SD/ELL category	Excluded	Assessed	Assessed without accommodations	Assessed with accommodations
SD and/or ELL	8	92	33	59
SD	8	92	23	69
ELL	9	91	52	39

NOTE: Students identified as both SD and ELL were counted only once under the combined SD and/or ELL category, but were counted separately under the SD and ELL categories. Detail may not sum to totals because of rounding.

13. What accommodations were offered in the 2018 TEL assessment? Which accommodations were the most commonly used?

Percentage of eighth-grade students identified as students with disabilities (SD) and/or English language learners (ELL) assessed in NAEP technology and engineering literacy (TEL) with accommodations, by SD/ELL category and type of accommodation: 2018

Type of accommodation	SD and/or ELL	SD	ELL
Bilingual dictionary	1.09	0.12	1.08
Breaks during test	2.71	2.61	0.27
Cueing to stay on task	1.08	1.06	0.07
Directions only presented in Sign Language	—	—	—
Extended time	9.72	8.26	2.24
Hearing impaired version of the test	0.06	0.06	—
Low mobility version of the test	—	—	—
Magnification	0.09	0.09	0.01
Must have an aide present in the testing room	0.22	0.22	0.01
Other	0.16	0.16	#
Preferential seating	—	—	—
Presentation in Sign Language	0.01	0.01	—
Responds orally to a scribe	0.10	0.10	—
Response in Sign Language	0.01	0.01	—
Separate session	0.53	0.51	0.09
Special equipment	0.68	0.67	0.08

Uses template	—	—	—

— Not available.
Percentages less than .005.
NOTE: Students identified as both SD and ELL were counted only once under the combined SD and/or ELL category, but were counted separately under the SD and ELL categories.

D. Reporting and interpreting results

14. How are TEL results reported?

NAEP TEL results for grade 8 are reported as average scores on a 0–300 scale. Scales for the three major content areas and the three practices were developed separately. Achievement levels are reported as the percentages of students performing at or above three NAEP achievement levels (*Basic*, *Proficient*, and *Advanced*) at the TEL overall level. *NAEP Proficient* performance is defined by the Governing Board as "competency over challenging subject matter."

The 2018 TEL report includes results for 7 scales:

- Overall TEL scale
- Content Areas
  - Technology and Society
  - Design and Systems
  - Information and Communication Technology
- Practices
  - Understanding Technological Principles
  - Developing Solutions and Achieving Goals
  - Communicating and Collaborating

Because the NAEP TEL scales were developed independently for each content area and practice, scale score results cannot be compared across content areas or practices. However, these reporting metrics greatly facilitate performance comparisons within each content area and practice from year to year and from one group of students to another in the same grade.

15. Are results for private schools included in the report?

No. Results for private schools are not included in the report because participation rates fell below the required standard for reporting results.

16. What survey questionnaire indices were created?

There are 9 survey questionnaire indices that were created for the 2018 TEL assessment. The names of these indices and their associated NAEP IDs in the NAEP Data Explore

(NDE) are listed below. The trend results are available for #1, 2, 3, 5 indices in the list to be compared to 2014.

1. TEL confidence index (SQCATT1)
2. Technology and Society related in-school learning index (SQCATT6)
3. Technology and Society related outside-of-school learning index (SQCATT2)
4. Design and Systems related in-school learning index (SQCATT7)
5. Design and Systems related outside-of-school learning index (SQCATT3)
6. Computer use in TEL index (SQCATT8)
7. Students' persistence in learning index (SQCATT9)
8. Students' academic self-discipline index (SQCATT10)
9. Students' enjoyment of complex problems index (SQCATT11)

17. How were the survey questionnaire indices developed?

As part of the NAEP TEL assessment, survey questionnaires are given to students and school administrators. These questionnaires collect contextual information to provide a better understanding of educational experiences and factors that are related to students' learning both in and outside of the classroom and to allow for meaningful student group comparisons.

While some survey questions are analyzed and reported individually (for example, number of books in students' homes), several questions on the same topic are combined into an index measuring a single underlying construct or concept. The creation of 2018 indices involved the following four main steps:

Selection of constructs of interest. The selection of constructs of interest to be measured through the survey questionnaires was guided in part by the National Assessment Governing Board framework for collection and reporting of contextual information. In addition, NCES reviewed relevant literature on key contextual factors linked to student achievement in TEL to identify the types of survey questions and constructs needed to examine these factors in the NAEP assessment.

Question development. Survey questions were drafted, reviewed, and revised. Throughout the development process, the survey questions were reviewed by external advisory groups that included survey experts, subject-area experts, teachers, educational researchers, and statisticians. As noted above, some questions were drafted and revised with the intent of analyzing and reporting them individually; others were drafted and revised with the intent of combining them into indices measuring constructs of interest.

Evaluation of questions. New and revised survey questions underwent pilot testing, whereby a small sample of participants (students, teachers, and school administrators) is interviewed to identify potential issues with their understanding of the questions and their ability to provide reliable and valid responses. Some questions were dropped or further revised based on the pilot test results. The questions were then field tested among a larger group of participants and responses were analyzed. The overall distribution of responses was examined to evaluate whether participants were answering the questions as expected. Relationships between survey responses and student performance were also examined. A method known as factor

analysis was used to examine the empirical relationships among questions to be included in the indices measuring constructs of interest. Factor analysis can show, based on relationships among responses to the questions, how strongly the questions "group together" as a measure of the same construct.

Index scoring. Using the item response theory (IRT) partial credit scaling model, index scores were estimated from students' responses and transformed onto a scale which ranged from 0–20.

18. Why are results not reportable for Native Hawaiian/Other Pacific Islander students in 2018?

A consideration in deciding whether to report an estimated quantity is whether the sample size is sufficient to detect a specific, minimum effect size. Below that sample size, the population representation of the sample becomes questionable. A second consideration is whether the standard error estimate that accompanies a statistic is itself sufficiently accurate to inform potential readers about the reliability of the statistic.

NAEP only reports student group results if the student sample size is 62 or more. Because students from Hawaii didn't participate the 2018 TEL assessment, only 44 Native Hawaiian/Other Pacific Islander students were assessed in TEL in 2018. So the sample size for this student group is insufficient to permit reliable estimates for reporting.

19. What might account for the 13-point non-significant score decrease between 2014 and 2018 for American Indian/Alaska Native (AI/AN) students?

In 2018, NAEP implemented new sampling procedures in order to increase the likelihood that the number of AI/AN students in national-only samples would exceed the minimum reporting threshold of 62. Schools with an AI/AN enrollment greater than five percent were given four times the chance of selection, which increased the AI/AN sample assessed from 116 students in 2014 to 222 students in 2018. However, almost half of the AI/AN students in the 2018 sample came from schools with a majority AI/AN population, while in 2014 no such schools were sampled. The average scale scores for AI/AN students in AI/AN majority schools tend to be lower than scores for AI/AN students in schools with a small AI/AN population, which might help explain the 13-point non-significant score decrease from 2014.

20. What were the TEL course taking results by gender?

There were no significant changes in percentages of male or female students who took industrial technology class compared to 2014. In 2018, the percentage of male students (15%) who took industrial technology class was higher than the percentage of female students (10%) by 5-percentage points. In 2014, the percentage of the male students was also higher than female students by 5-percentage points.

The percentage of male students who took engineering class in 2018 (30%) was higher than the percentage in 2014 (23%), and the percentage of female students in 2018 (21%) was also higher than in 2014 (15%). In 2018, male students (30%) had a higher percentage taking engineering class than female student (21%) by 9-percentage points; in 2014, male students (23%) also had a higher percentage than female students (15%) by 8-percentage points.

The percentage of male students who took class to use/program/build computers in 2018 (31%) was higher than the percentage in 2014 (27%), while this percentage was not statistically significant for female student between 2014 and 2018. In 2018, a higher percentage of male student (31%) took computer-related class than female students (27%), while in 2014, there was no significant difference between the percentages of male and female students who took computer-related class.

The percentage of male students who took the other technology-related class in 2018 (29%) was higher than the percentage in 2014 (25%), while this percentage was not statistically significant for female student between 2014 and 2018. There was no significant differences in the percentages of taking the other technology-related class between male and female students in both 2014 and 2018.

The percentage of male students who took at least one technology/engineering-related class in 2018 (61%) was higher than the percentage in 2014 (55%), while this percentage was not statistically significant for female student between 2014 and 2018. In 2018, male students (61%) had a higher percentage taking at least one technology/engineering-related class than female student (53%) by 9-percentage points; in 2014, male students (55%) also had a higher percentage than female students (49%) by 6-percentage points.

	2014			2018		
Technology/engineering-related classes	Male	Female	Percentage difference	Male	Female	Percentage difference
Industrial technology	15	10	5	15	10	5
Engineering	23	15	8	**30**	**21**	9
Computer	27	25	1	**31**	27	3
Any other technology-related class	25	26	1	**29**	28	1
At least one technology/engineering-related class	55	49	6	**61**	53	9

Blue circle: significant percentage difference between male and female students.

Grey circle: No significant percentage difference between male and female students.

Bold blue font type: percentage higher than 2014.