Skills of U.S. Unemployed, Young, and Older Adults in Sharper Focus:

Results From the Program for the International Assessment of Adult Competencies (PIAAC) 2012/2014

First Look

:ies NATIONAL CENTER FOR EDUCATION STATISTICS

Institute of Education Sciences

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MARCH 2016

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Introduction

What Is PIAAC?

The **Program for the International Assessment of Adult Competencies (PIAAC)** is a cyclical, large-scale study of adult skills and life experiences focusing on education and employment. Nationally representative samples of adults between the ages of 16 and 65 are administered an assessment of literacy, numeracy, and problem solving in technology rich environments, as well as survey questions about their educational background, work history, the skills they use on the job and at home, their civic engagement, and sense of their health and well-being. The results are used to compare participating countries on the skills capacities of their workforce-aged adults and to learn more about relationships between educational background and employment and other outcomes.

PIAAC is coordinated by the Organization for Economic Cooperation and Development (OECD) and developed by participating countries with the support of the OECD. PIAAC was first administered in 2011-12 in the United States and 23 other countries.[1]

What Is the U.S. PIAAC National Supplement?

The U.S. PIAAC National Supplement is the second PIAAC data collection in the United States. Conducted from August 2013 through April 2014, the National Supplement's household data collection surveyed 3,660 adults from three key U.S. subgroups of interest:

- unemployed adults (age 16 to 65);
- young adults (age 16 to 34); and
- older adults (age 66 to 74).

In addition to a household data collection, the National Supplement also surveyed 1,319 respondents from a target population defined as adult inmates (age 16 to 74) detained in federal and state prisons in the United States.[2]

The second round of U.S. PIAAC household data collection repeated the same procedures, instruments, and assessments that were used for the first round of data collection (called the "2012 PIAAC Main Study") in the same sampled areas (or primary sampling units). However, while the first round collected data from a nationally representative sample of 5,010 adults, the second round collected data from 3,660 adults from only the three targeted (or oversampled) subgroups of interest. Together, the two rounds of U.S. PIAAC household data collection provide a nationally representative sample of 8,670 noninstitutionalized adults in the United States between the ages of 16 and 74. It is important to note, however, that the second round of data is, by design, an oversample to supplement the first round of data collection and, hence, can only be used together with the first round of data.

Why Was the National Supplement Conducted?

The National Supplement was conducted for two reasons. First, augmenting the U.S. PIAAC sample permits more in-depth analyses of the cognitive and workplace skills of the U.S. population, in particular of the three key U.S. subgroups listed above. Second, the additional information on adults age 66 to 74 and incarcerated adults makes PIAAC data comparable with data collected by NCES in the 2003 National Assessment of Adult Literacy (NAAL). This in turn makes it possible to analyze change in adult skills over the decade between the two studies.

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[1] In addition to the 23 countries that participated in PIAAC in 2012, 9 more countries (Chile, Greece, Indonesia, Israel, Lithuania, New Zealand, Singapore, Slovenia, and Turkey) took part in PIAAC in 2014. These additional countries will be added to the international PIAAC dataset in 2016 and thus are not included in the International Average shown in this report. These data will be available from the OECD and on the OECD International Data Explorer (IDE) at http://www.oecd.org/site/piaac/publicdataandanalysis.htm.

[2] Results from the prison data collection will be released in a separate report.

What Does PIAAC Measure?

PIAAC is designed to assess adults in different countries over a broad range of abilities, from simple reading to complex problem-solving skills, and to collect information on individuals' skill use and background. PIAAC defines four core competency domains of adult cognitive skills that are seen as key to facilitating the social and economic participation of adults in advanced economies: literacy, reading components, numeracy, and problem solving in technology-rich environments. All participating countries and regions are required to assess the literacy and numeracy domains, but the reading components and problem solving in technology-rich environments domains are both optional. The United States assessed all four domains. For a list of the subject experts who contributed to the development of the PIAAC assessment, see appendix A. For a more detailed description of the four domains, see appendix B.

Tasks developed for PIAAC's four domains are authentic, culturally appropriate, and drawn from real-life situations that are expected to be important or relevant in different contexts. Tasks are intended to reflect adults' daily lives across cultures, even if not every adult is necessarily familiar with every task. PIAAC is not designed to provide individual scores, but rather to measure how groups of adults perform on the domains. In order to be as efficient as possible with participants' time, each respondent receives only a portion of the assessment items (see the Data Collection section of appendix C for more detail).

Literacy

The primary goal of PIAAC's literacy assessment is to measure everyday literacy, which is defined by the PIAAC framework as "*understanding, evaluating, using and engaging with written text to participate in society, to achieve one's goals and to develop one's knowledge and potential*" (OECD 2012).

Reading components

The primary goal of the PIAAC reading components measure is to provide information about the literacy skills of adults at the lower end of the literacy spectrum—specifically, whether they have the foundational skills to develop the higher literacy and numeracy abilities necessary for functioning in society. The reading components assessment focuses on elements of reading that are comparable across the range of languages in the participating countries: reading vocabulary, sentence comprehension, and basic passage comprehension. Note that results for this domain are not shown in this report.

Numeracy

The primary goal of PIAAC's numeracy assessment is to evaluate basic mathematical and computational skills that are considered fundamental for functioning in everyday work and social life. Numeracy in the PIAAC framework is defined as "*the ability to access, use, interpret, and communicate mathematical information and ideas, to engage in and manage mathematical demands of a range of situations in adult life*" (OECD 2012).

Problem solving in technology-rich environments

PIAAC represents the first attempt to assess problem solving in technology-rich environments on a large scale and as a single dimension in an international context. PIAAC defines problem solving in technology-rich environments as "*using digital technology, communication tools, and networks to acquire and evaluate information, communicate with others, and perform practical tasks*" (OECD 2012).

Skill use and the background questionnaire

In addition to the skills assessment, PIAAC's background questionnaire surveys adults about their educational background; work history; their intrapersonal, interpersonal, and professional skills; and their use of those skills on the job and at home.

Reporting Results

The purpose of this report is to present selected results from the first and second rounds of the U.S. PIAAC household data collection (PIAAC 2012/2014).[3] PIAAC results are reported in two ways: (1) as scale scores (estimated on a 0–500 scale) in the three domains of literacy, numeracy, and problem solving in technology-rich environments,[4] and (2) as percentages of adults reaching the proficiency levels established for each of these domains.

PIAAC reports five proficiency levels for literacy and numeracy (Below level 1, Level 1, Level 2, Level 3, and Level 4/5) and four levels for problem solving in technology-rich environments (Below level 1, Level 1, Level 2, and Level 3). The OECD provides detailed descriptions of the types of skills that can be performed at each level. For example, adults at Level 1 in literacy can "read relatively short…texts to locate a single piece of information that is identical to or synonymous with the information given in the question or directive" and can "enter personal information onto a document" when "[l]ittle, if any, competing information is present." However, adults at Level 1 typically are not successful performing skills at the higher levels (e.g., "compare and contrast or reason about information requested" or "navigate within digital texts to access and identify information from various parts of a document," both of which are Level 2 literacy skills). Appendix B provides the OECD's detailed descriptions of these levels along with examples of assessment items at each level.

This report follows OECD reporting conventions by combining the top two proficiency levels (Levels 4 and 5) for the literacy and numeracy scales (OECD 2013). Across all countries, only 2 percent or less of adults performed at Level 5 in literacy and numeracy.

This report also provides an international average for scale scores and proficiency levels for variables that are internationally comparable. The international averages in figures 3, 4, 5, 6, and 8 represent the averages for all participating countries and regions shown in this report and may differ slightly from the international averages reported in the 2012 NCES *First Look* (Goodman et al., 2013) (see below for details).

How Does this *First Look* Report Differ from the 2012 PIAAC *First Look*?

NCES's 2012 PIAAC *First Look* (Goodman et al., 2013) released in October 2013 presented data from the 2012 PIAAC Main Study. It focused on adult skills in the United States compared to the average of countries that participated in PIAAC in 2012 (the PIAAC international average), by major demographic characteristics. This *First Look* report presents the U.S. PIAAC 2012/2014 data, which supports more detailed and precise esti-mates.[5] This *First Look* report updates some of the comparisons in the previous report, but also presents new results for unemployed adults, young adults, and older adults, which can now be analyzed because a larger sample is available to reliably estimate performance for these groups.

The PIAAC international averages in the 2012 PIAAC *First Look* report were calculated using the U.S. 2012 data and restricted-use data for Australia and Canada. However, data from Australia and Canada are not available because of national restrictions on the use of their data. Thus, the PIAAC international averages in figures 3, 4, 5, 6, and 8 in this report were calculated (a) without Australian data, (b) with Canada's publicly available PIAAC data, and (c) with the U.S. PIAAC 2012/2014 data. Differences in the international averages calculated for the 2012 PIAAC *First Look* and those calculated for this report are very small but, on account of them, some estimates round differently.

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[3] The "Selected Findings" in this report highlight results in some but not all figures presented in this report.

[4] Results from the reading components portion of the assessment are not reported in this report, but can be accessed from the IDE at http://www.oecd.org/site/piaac/publicdataandanalysis.htm.

[5] Besides the larger combined sample, the improved accuracy of estimates in this report is due in part to the revised population estimates based on the Census 2010 data, which were unavailable when PIAAC 2012 went into the field. For more details, see appendix C - Changes in Population Totals from 2012 Main Study.

The percentage distribution of the population by key reporting variables is displayed in table 1 for all U.S. adults age 16-65, unemployed adults age 16-65, young adults age 16-34, and older adults age 66-74.

Readers are cautioned not to draw causal inferences from results presented in this report. Many of the variables examined in this report may be related to one another, but the complex interactions and relationships among them have not been explored. The variables examined here are also just a few of the variables that can be examined in these data; they were selected to demonstrate the range of information available from the study. The release of this report is intended to encourage more in-depth analysis of the data using more sophisticated statistical methods.

All statistically significant differences described in this report are significant at the .05 level. No statistical adjustments to account for multiple comparisons were used. Differences that are statistically significant are discussed using comparative terms such as "higher" and "lower." Differences that are not statistically significant are either not discussed or referred to as "not measurably different" or "not statistically significant." In this case, failure to find a difference as statistically significant does not necessarily mean that there was no difference. It could be that a real difference cannot be detected by the significance test because of a small sample size or an imprecise measurement in the sample. If the statistical test is significant, this means that there is convincing evidence (though no guarantee) of a real difference in the population. However, it is important to remember that statistically significant results do not necessarily identify those findings that have policy significance or practical importance. See appendix C for more information about statistical testing.

This report provides findings for only a few select results, but more PIAAC results and resources are available from

- The PIAAC Results Portal http://nces.ed.gov/surveys/piaac/results/makeselections.aspx.
- The OECD's PIAAC webpages http://www.oecd.org/site/piaac/.
- The International Data Explorer (IDE) http://nces.ed.gov/surveys/piaac/ideuspiaac/.

A Brief History of PIAAC

PIAAC's development was based upon the pioneering work of national adult literacy assessments undertaken by the United States and Canada. In the United States, the first national assessment of literacy was the 1985 Young Adult Literacy Study (YALS), which was followed in 1992 by the National Adult Literacy Survey (NALS) and in 2003 by the National Assessment of Adult Literacy (NAAL). U.S. participation in international adult literacy assessments began in 1994 with the International Adult Literacy Survey (IALS), followed in 2003 by the Adult Literacy and Lifeskills Survey (ALL).

Drawing on the knowledge and experience gained from these earlier national and international large-scale adult literacy assessments, PIAAC improves on these studies' content frameworks, design, and methodologies to provide better measurement. PIAAC also extends the definitions of literacy and numeracy used by IALS and ALL; however, to ensure continuity with these previous studies and permit measurements of trend, PIAAC includes items from both IALS and ALL.

Besides building on these earlier national and international studies, PIAAC includes various innovations that set it apart from these earlier studies. For example, PIAAC is the first large-scale assessment to be adaptive and administered on laptop computers to respondents in their homes. PIAAC provides more information about individuals with low levels of literacy by assessing reading component skills. To assess adults' knowledge and skills for the digital age, PIAAC developed a new problem-solving domain with an emphasis on skills used in digital or technology-rich environments.

Selected Findings

Overall summary for adults age 16-65

In literacy, the U.S. average score (272) was not measurably different than the PIAAC international average score (273) (see figure 1-A). Compared with the PIAAC international average distribution of literacy skills, the United States had a larger percentage of adults performing at both the top and the bottom of the distribution (13 versus 12 percent at Level 4/5, and 18 versus 16 percent[6] at Level 1 and below, see figure 2-A).

In numeracy and problem solving in technology-rich environments, the United States performed below the PIAAC international average. In numeracy, the U.S. average score was 12 points lower than the PIAAC international average score (257 versus 269, see figure 1-B), and in problem solving in technology-rich environments, the U.S. average score was 9 points lower than the international average (274 versus 283, see figure 1-C). Compared with the international average distributions for these skills, the United States had

- a smaller percentage at the top (10 versus 12 percent at Level 4/5 in numeracy, and 5 versus 8 percent at Level 3 in problem solving in technology-rich environments, see figures 2-B and 2-C), and
- a larger percentage at the bottom (28 versus 19 percent[6] in numeracy, and 64 versus 55 percent[6] in problem solving in technology-rich environments at Level 1 and below).

Overall summary for U.S. adults age 16-74 by age[7]

The U.S. distribution of skills in each of the three domains for adults age 16-74, by age, suggested a relationship between age and performance. In literacy, the percentages of adults performing at the top proficiency level (4/5) were larger for adults age 25-34 and 35-44 than for adults at the other 10-year age intervals. In numeracy, the percentages of adults performing at the top proficiency level (4/5) were larger for those age 25-34 and 35-44 than those age 55-65 and 66 and older. For adults in the youngest age interval (16-24), the percentages at the top proficiency levels (4/5 for literacy and numeracy and 3 for problem solving in technology-rich environments) were consistently smaller than for adults age 25-34 (see figures 10-A, 10-B, and 10-C).

Overall summary for U.S. adults age 16-65 by employment status

In literacy, 15 percent of employed adults age 16-65 performed at the top proficiency level (4/5), while in numeracy 12 percent of employed adults reached this level. In both cases, the percentage of employed adults at the top proficiency level was larger than that of unemployed adults (7 percent in literacy and 4 percent in numeracy) and adults who were out of the labor force (9 percent in literacy and 6 percent in numeracy) (see figures 3-A and 3-B).

Similarly, across all three domains, a larger percentage of adults age 16-65 who were unemployed and out of the labor force performed at or below Level 1 compared with adults who were employed (see figures 3-A, 3-B, and 3-C).

Overall summary for unemployed adults age 16-65

About 75 percent of unemployed U.S. adults age 16-65 had a high school credential or less education. Roughly a third of these adults performed at Level 1 or below in literacy (26 to 38 percent) and about half performed at Level 1 or below in numeracy (47 to 58 percent) (see figures 4-A and 4-B).

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[6] Values for combined categories do not match figure due to rounding.

[7] These findings for the expanded U.S. adult population do not follow the sequence of figures in the report. The figures in the report are ordered to keep data in the same age ranges grouped together for ease of reference, whereas the Selected Findings on this page are ordered logically from the most general to more specific findings.

The relationship between age and performance that was noted above among all U.S. adults differed for unemployed adults. Instead of the percentage of adults at the top proficiency level being smaller at older ages, among unemployed adults there was no measurable difference at the top proficiency level (4/5) in literacy and numeracy between those age 55-65 and age 25-34 (8 versus 6 percent in literacy and 5 versus 4 percent in numeracy) (see figures 5-A and 5-B).

Comparing internationally, among unemployed adults age 16-65, larger percentages of both males and females in the United States performed at the bottom of the proficiency distribution (Level 1 or below) in numeracy and problem solving in technology-rich environments than is the case, on average, across the participating PIAAC countries (see figures 6-B and 6-C).

Among unemployed U.S. adults age 16-65, larger percentages of unemployed White adults performed at the top proficiency level in all three domains (4/5 for literacy and numeracy and 3 for problem solving in technology-rich environments) than Black and Hispanic adults (12 versus 1 and 2 percent in literacy, 7 versus 1 and 2 percent in numeracy, and 5 versus 1 percent each in problem solving in technology-rich environments)(see figures 7-A, 7-B, and 7-C).

Overall summary for young adults age 16-34

Among young adults age 16-34, the U.S. distribution of skills in each of the three domains by educational attainment suggested a relationship between education and performance. In general, the higher the level of education completed, the larger the percentages of young adults at the top proficiency levels (4/5 for literacy and numeracy and 3 for problem solving in technology-rich environments) and the smaller the percentages at the bottom (Level 1 and below) (see figures 8-A, 8-B, and 8-C).

Comparing internationally, among young adults age 16-34 whose highest level of education was high school or less, larger percentages in the United States performed at the bottom of the proficiency distribution (Level 1 or below) in all three domains than is the case, on average, across the participating PIAAC countries (see figures 8-A, 8-B, and 8-C).

In the United States, smaller percentages of Black and Hispanic young adults age 16-34 performed at the top proficiency level (4/5) in literacy (4 and 5 percent) than their peers who reported their race/ethnicity as White or Other (20 and 17 percent) (see figure 9-A).

Overall summary for older U.S. adults age 66-74

In literacy and numeracy, there were no measurable differences in the percentage of older U.S. adults age 66-74 who performed at the highest proficiency level (4/5) between those who had a graduate or professional degree and those who had a bachelor's degree as their highest educational attainment (19 versus 19 percent in literacy and 18 versus 15 percent in numeracy) (see figures 11-A and 11-B). This differed from the pattern among young adults described above.

Among older U.S. adults age 66-74, a greater percentage of those employed compared with those out of the labor force performed at the highest proficiency level (4/5) in numeracy (10 versus 4 percent) (see figure 12-B).

Older U.S. adults age 66-74 who reported that their health status was "fair" had a larger percentage at the bottom of the proficiency distribution (Level 1 and below) in literacy and numeracy than their peers who reported that their health status was "good," "very good," or "excellent" (see figures 13-A and 13-B).

Tables and Figures

Table 1. Percentage of U.S. adults in selected population groups, by selected characteristics: 2012 and 2014[1]

Characteristic	All adults, age 16 to 65	Unemployed adults, age 16 to 65	Young adults, age 16 to 34	Older adults, age 66 to 74
Highest level of educational attainment				
Graduate or professional degree	10	5	6	13
Bachelor's degree	17	10	16	14
Associate's degree	9	8	9	6
High school credential	50	54	49	53
Below high school	14	23	20	14
10-year age intervals				
16–24	18	33	48	†
25–34	20	18	52	†
35–44	20	17	†	†
45–54	21	17	†	†
55–65	20	14	†	†
66–74	†	†	†	100
Race/ethnicity				
White	65	52	59	81
Black	13	21	14	8
Hispanic	15	19	19	6
Other	7	8	8	5
Gender				
Male	49	47	51	47
Female	51	53	49	53
Highest level of parental education				
At least one parent attained college degree	39	35	50	19
At least one parent attained high school degree	44	49	39	43
Neither parent attained high school degree	17	16	11	39
Born in the United States				
Yes	85	88	88	89
No	15	12	12	11
Self-reported health status				
Excellent	23	20	29	14
Very good	33	29	35	29
Good	28	32	27	33
Fair	11	15	8	18
Poor	4	3	1	6
Diagnosed or identified as having a learning disability				
Yes	8	13	10	4
No	92	87	90	96

† Not applicable.

[1] United States data are the U.S. PIAAC 2012/2014 data.

NOTE: The results shown in the table are based on the PIAAC literacy scale. Results from the PIAAC numeracy and problem solving in technology-rich environments scales are similar to the results from the literacy scale. Black includes African American, and Hispanic includes Latino. Race categories exclude Hispanic origin. Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Program for the International Assessment of Adult Competencies (PIAAC), U.S. PIAAC 2012/2014; Organization for Economic Cooperation and Development, PIAAC 2012.

Adults age 16 to 65

Figure 1-A. Average scores on the PIAAC literacy scale for adults age 16 to 65, by participating country and region: 2012 and 2014[1]
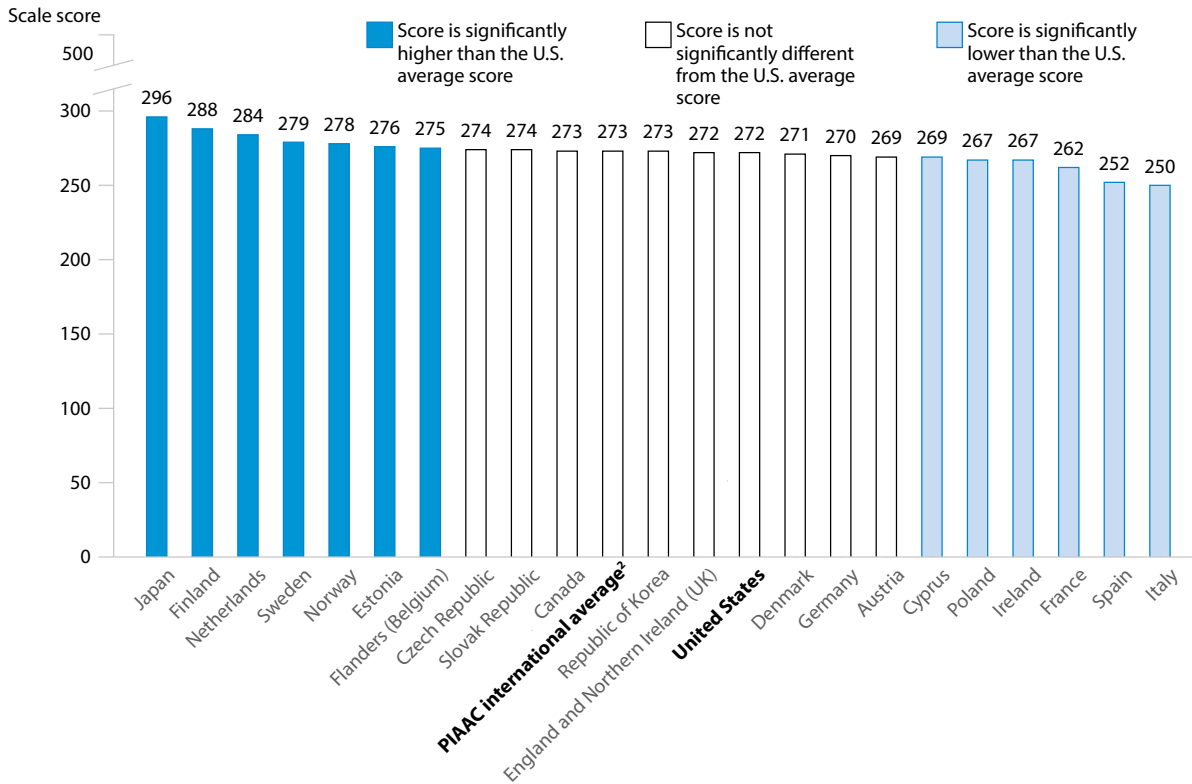
Figure 1-B. Average scores on the PIAAC numeracy scale for adults age 16 to 65, by participating country and region: 2012 and 2014[1]
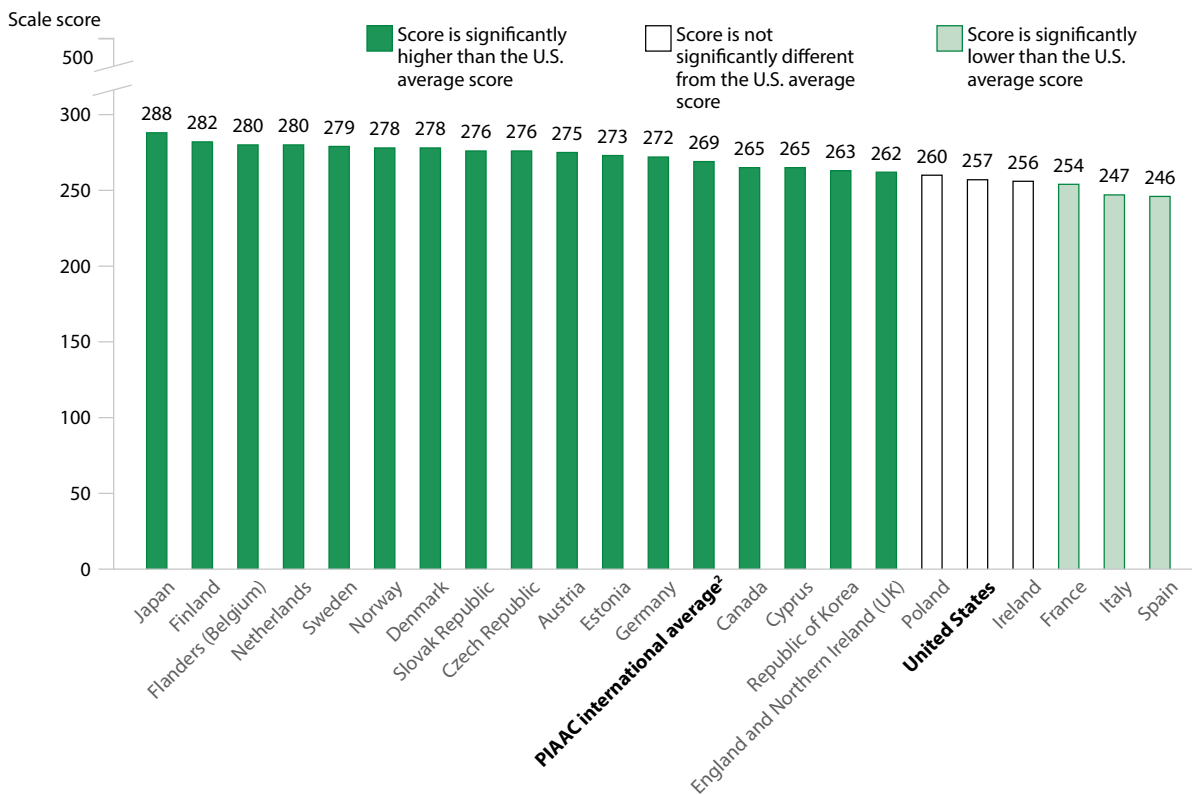
[1] Data for all countries are from 2012, except for the United States which are the U.S. PIAAC 2012/2014 data.

[2] PIAAC 2012 international average based on all countries and regions that participated in PIAAC 2012 as reported in the 2012 NCES *First Look* (Goodman et al., 2013). Country- and region-specific results are available at http://nces.ed.gov/surveys/piaac/results/makeselections.aspx.

NOTE: Countries and regions are listed in descending order determined by their unrounded average scores. Apparent differences between estimates may not be statistically significant. Some population groups did not have enough sample size to meet the minimum reporting standards.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Program for the International Assessment of Adult Competencies (PIAAC), U.S. PIAAC 2012/2014; Organization for Economic Cooperation and Development, PIAAC 2012.

Figure 1-C. Average scores on the PIAAC problem solving in technology-rich environments scale for adults age 16 to 65, by participating country and region: 2012 and 2014[1]
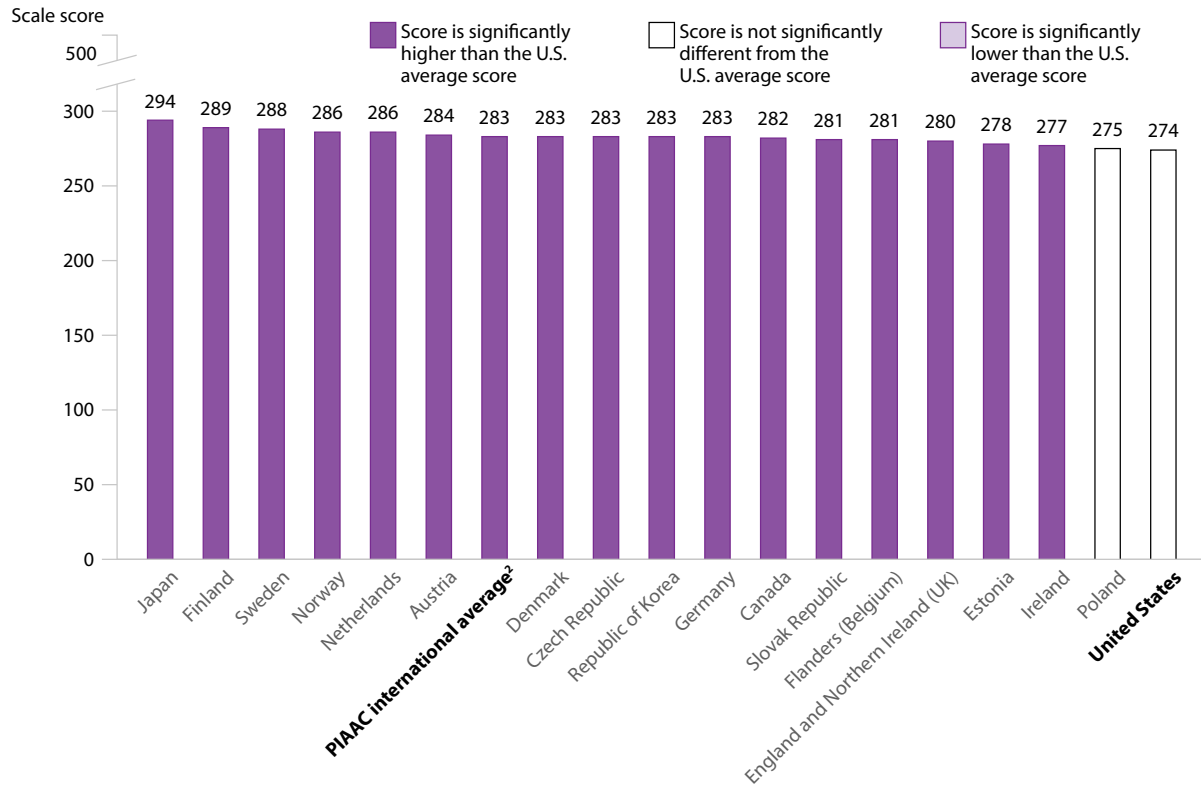
Scale score

Country/Region	Score
Japan	294
Finland	289
Sweden	288
Norway	286
Netherlands	286
Austria	284
PIAAC international average[2]	283
Denmark	283
Czech Republic	283
Republic of Korea	283
Germany	283
Canada	282
Slovak Republic	281
Flanders (Belgium)	281
England and Northern Ireland (UK)	280
Estonia	278
Ireland	277
Poland	275
United States	274

Legend: Score is significantly higher than the U.S. average score | Score is not significantly different from the U.S. average score | Score is significantly lower than the U.S. average score

[1] Data for all countries are from 2012, except for the United States which are the U.S. PIAAC 2012/2014 data.

[2] PIAAC 2012 international average based on all countries and regions that participated in PIAAC 2012 as reported in the 2012 NCES *First Look* (Goodman et al., 2013). Country- and region-specific results are available at http://nces.ed.gov/surveys/piaac/results/makeselections.aspx.

NOTE: Countries and regions are listed in descending order determined by their unrounded average scores. No countries or regions scored significantly lower than the United States. Apparent differences between estimates may not be statistically significant. Some population groups did not have enough sample size to meet the minimum reporting standards. Not all countries chose to assess the problem solving in technology-rich environments domain. In countries that did, the percentage of respondents who completed the assessment varied widely from country to country but was less than the percentage that completed the literacy and numeracy domain because the assessment was only offered on computer. In the United States, approximately 15 percent of respondents chose not to take the assessment on computer or were unable to do so (see appendix C for more detailed information).

SOURCE: U.S. Department of Education, National Center for Education Statistics, Program for the International Assessment of Adult Competencies (PIAAC), U.S. PIAAC 2012/2014; Organization for Economic Cooperation and Development, PIAAC 2012.

Figure 2-A. Percentage of adults age 16 to 65 at each level of proficiency on the PIAAC literacy scale: 2012 and 2014

United States[1]: Below level 1: 4, Level 1: 13, Level 2: 33, Level 3: 36, Level 4/5: 13

PIAAC international average[2]: Below level 1: 3, Level 1: 12, Level 2: 34, Level 3: 39, Level 4/5: 12

Percent

☐ Below level 1   ☐ Level 1   ☐ Level 2   ☐ Level 3   ☐ Level 4/5

Figure 2-B. Percentage of adults age 16 to 65 at each level of proficiency on the PIAAC numeracy scale: 2012 and 2014

United States[1]: Below level 1: 8, Level 1: 19, Level 2: 34, Level 3: 29, Level 4/5: 10

PIAAC international average[2]: Below level 1: 5, Level 1: 14, Level 2: 34, Level 3: 35, Level 4/5: 12

Percent

☐ Below level 1   ☐ Level 1   ☐ Level 2   ☐ Level 3   ☐ Level 4/5

Figure 2-C. Percentage of adults age 16 to 65 at each level of proficiency on the PIAAC problem solving in technology-rich environments scale: 2012 and 2014

United States[1]: Below level 1: 23, Level 1: 41, Level 2: 31, Level 3: 5

PIAAC international average[2]: Below level 1: 16, Level 1: 39, Level 2: 37, Level 3: 8

Percent

☐ Below level 1   ☐ Level 1   ☐ Level 2   ☐ Level 3

[1] United States data are the U.S. PIAAC 2012/2014 data.

[2] PIAAC 2012 international average based on all countries and regions that participated in PIAAC 2012 as reported in the 2012 *First Look* (NCES 2013-008). Country- and region-specific results are available at http://nces.ed.gov/surveys/piaac/results/makeselections.aspx.

NOTE: Detail may not sum to totals because of rounding. Apparent differences between estimates may not be statistically significant. Some population groups did not have enough sample size to meet the minimum reporting standards. Not all countries chose to assess the problem solving in technology-rich environments domain. In countries that did, the percentage of respondents who completed the assessment varied widely from country to country but was less than the percentage that completed the literacy and numeracy domain because the assessment was only offered on computer. In the United States, approximately 15 percent of respondents chose not to take the assessment on computer or were unable to do so (see appendix C for more detailed information).

SOURCE: U.S. Department of Education, National Center for Education Statistics, Program for the International Assessment of Adult Competencies (PIAAC), U.S. PIAAC 2012/2014; Organization for Economic Cooperation and Development, PIAAC 2012.

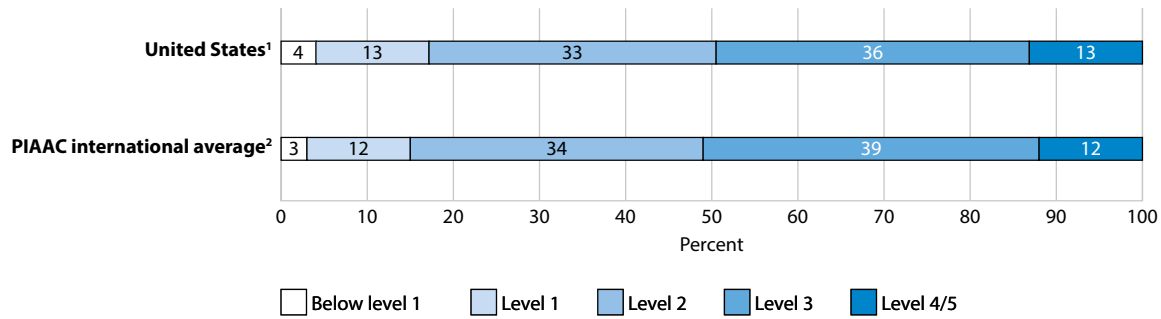**Figure 3-A. Percentage of adults age 16 to 65 at each level of proficiency on the PIAAC literacy scale, by employment status: 2012 and 2014[1]**

United States

	Below level 1	Level 1	Level 2	Level 3	Level 4/5
Employed (74)	3	11	31	39	15
Unemployed (7)	4	20	40	29	7
Out of the labor force (19)	7	19	38	26	9
Overall	4	13	33	36	13

PIAAC international average

	Below level 1	Level 1	Level 2	Level 3	Level 4/5
Employed (69)	2	11	33	41	13
Unemployed (6)	5	15	37	34	9
Out of the labor force (26)	6	17	37	33	8
Overall	3	12	34	39	12

Percent (0 to 100)

Legend: ☐ Below level 1 ☐ Level 1 ☐ Level 2 ☐ Level 3 ☐ Level 4/5
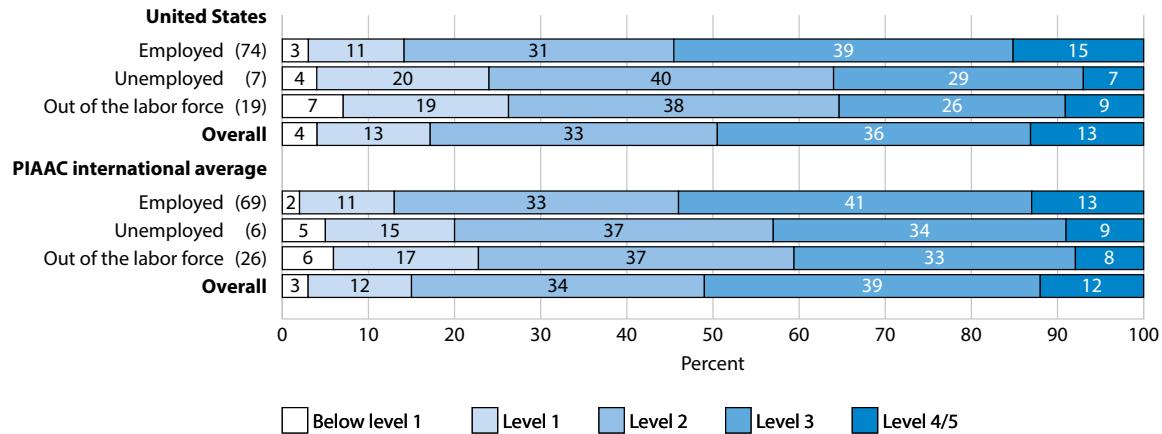
Figure 3-B. Percentage of adults age 16 to 65 at each level of proficiency on the PIAAC numeracy scale, by employment status: 2012 and 2014[1]

United States

	Below level 1	Level 1	Level 2	Level 3	Level 4/5
Employed (74)	6	17	33	32	12
Unemployed (7)	11	31	36	18	4
Out of the labor force (19)	14	26	34	20	6
Overall	8	19	34	29	10

PIAAC international average

	Below level 1	Level 1	Level 2	Level 3	Level 4/5
Employed (69)	3	12	33	38	14
Unemployed (6)	8	19	37	29	8
Out of the labor force (26)	9	19	36	29	7
Overall	5	14	34	35	12

Percent (0 to 100)

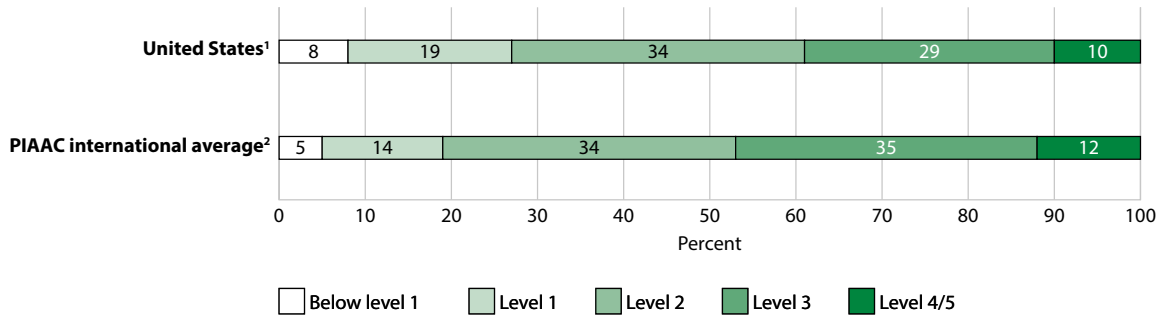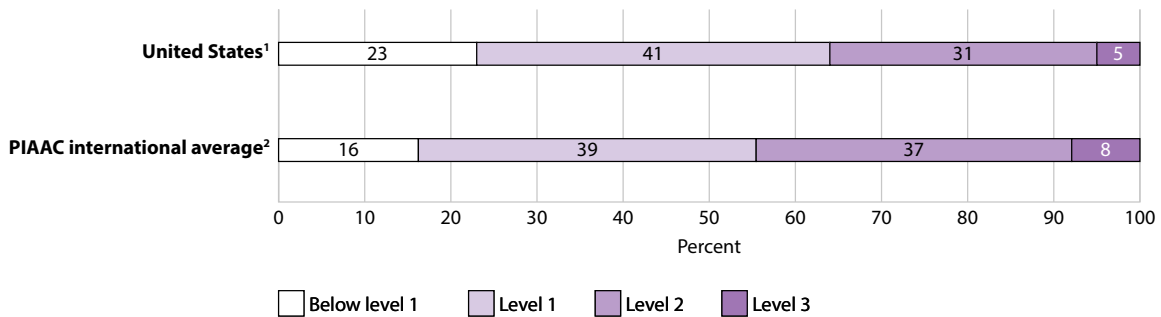Legend: ☐ Below level 1 ☐ Level 1 ☐ Level 2 ☐ Level 3 ☐ Level 4/5

Figure 3-C. Percentage of adults age 16 to 65 at each level of proficiency on the PIAAC problem solving in technology-rich environments scale, by employment status: 2012 and 2014[1]

United States

	Below level 1	Level 1	Level 2	Level 3
Employed (77)	21	41	33	6
Unemployed (7)	30	43	24	3
Out of the labor force (16)	26	44	26	4
Overall	23	41	31	5

PIAAC international average

	Below level 1	Level 1	Level 2	Level 3
Employed (74)	16	39	38	8
Unemployed (5)	18	42	34	6
Out of the labor force (21)	21	39	34	6
Overall	17	39	37	8

Percent (0 to 100)

Legend: ☐ Below level 1 ☐ Level 1 ☐ Level 2 ☐ Level 3

[1] United States data are the U.S. PIAAC 2012/2014 data. PIAAC international average is calculated from the U.S. PIAAC 2012/2014 data and international data from 2012 for all other countries shown in this report. Country- and region-specific results are available at http://nces.ed.gov/surveys/piaac/results/makeselections.aspx.
NOTE: Percentages of adults age 16 to 65 by employment status appear in parentheses. The percentage distribution for problem solving in technology-rich environments scale includes only those adults who took the problem solving in technology-rich environments assessment. Approximately 15 percent of the U.S. sample chose not to take the assessment on computer or were unable to do so and therefore did not take the problem solving in technology-rich environments assessment (see appendix C for more detailed information). The unemployed comprise all persons above a specified age who during the reference period were in the following categories: without work, that is, were not in paid employment or self-employment during the reference period; currently available for work, that is, were available for paid employment or self-employment during the reference period; and seeking work, that is, had taken specific steps in a specified recent period to seek paid employment or self-employment. Out of the labor forces comprise all persons not classified as either employed or unemployed. Detail may not sum to totals because of rounding. Apparent differences between estimates may not be statistically significant. Some population groups did not have enough sample size to meet the minimum reporting standards.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Program for the International Assessment of Adult Competencies (PIAAC), U.S. PIAAC 2012/2014; Organization for Economic Cooperation and Development, PIAAC 2012.

Unemployed adults age 16 to 65

Figure 4-A. Percentage of unemployed adults age 16 to 65 at each level of proficiency on the PIAAC literacy scale, by highest level of educational attainment: 2012 and 2014[1]

United States
- Graduate or professional degree (5): ‡
- Bachelor's degree (10): 1, 6, 27, 43, 23
- Associate's degree (8): #, 8, 34, 50, 9
- High school credential (54): 3, 22, 44, 26, 5
- Below high school (23): 9, 29, 41, 20, 1
- Overall: 4, 20, 40, 29, 7

PIAAC international average
- Graduate or professional degree[2] (6): #, 25, 58, 17
- Bachelor's degree (8): 1, 6, 26, 48, 20
- Associate's degree (8): 1, 9, 32, 46, 12
- High school credential (49): 3, 14, 40, 36, 7
- Below high school (31): 9, 28, 42, 19, 2
- Overall: 5, 15, 37, 34, 9

Legend: Below level 1, Level 1, Level 2, Level 3, Level 4/5
Percent

Figure 4-B. Percentage of unemployed adults age 16 to 65 at each level of proficiency on the PIAAC numeracy scale, by highest level of educational attainment: 2012 and 2014[1]

United States
- Graduate or professional degree (5): ‡
- Bachelor's degree (10): 1, 12, 33, 40, 13
- Associate's degree (8): 2, 17, 39, 34, 9
- High school credential (54): 11, 35, 39, 14, 2
- Below high school (23): 21, 38, 31, 10, 1
- Overall: 11, 31, 36, 18, 4

PIAAC international average
- Graduate or professional degree[2] (6): 4, 35, 51, 10
- Bachelor's degree (8): 2, 9, 33, 41, 15
- Associate's degree (8): 3, 16, 39, 34, 8
- High school credential (49): 5, 17, 40, 30, 7
- Below high school (31): 16, 33, 36, 13, 1
- Overall: 8, 19, 37, 29, 8

Legend: Below level 1, Level 1, Level 2, Level 3, Level 4/5
Percent

Figure 4-C. Percentage of unemployed adults age 16 to 65 at each level of proficiency on the PIAAC problem solving in technology-rich environments scale, by highest level of educational attainment: 2012 and 2014[1]

United States
- Graduate or professional degree (6): ‡
- Bachelor's degree (11): 13, 33, 44, 9
- Associate's degree (8): 20, 46, 32, 2
- High school credential (54): 35, 43, 20, 2
- Below high school (21): 35, 46, 17, 2
- Overall: 30, 43, 24, 3

PIAAC international average
- Graduate or professional degree (8): 13, 45, 36, 5
- Bachelor's degree (9): 10, 34, 44, 11
- Associate's degree (8): 15, 42, 38, 5
- High school credential (53): 18, 42, 33, 6
- Below high school (25): 27, 46, 25, 3
- Overall: 18, 42, 34, 6

Legend: Below level 1, Level 1, Level 2, Level 3
Percent

Rounds to zero.

‡ Reporting standards not met. Sample size insufficient to permit a reliable estimate.

[1] United States data are the U.S. PIAAC 2012/2014 data. PIAAC international average is calculated from the U.S. PIAAC 2012/2014 data and international data from 2012 for all other countries shown in this report. Country- and region-specific results are available at http://nces.ed.gov/surveys/piaac/results/makeselections.aspx.

[2] The PIAAC international average results for below level 1 of proficiency on the PIAAC literacy and numeracy scales are not available for unemployed adults age 16 to 65 whose highest level of education attainment is graduate or professional degree.

NOTE: Percentages of unemployed adults age 16 to 65 by highest level of educational attainment appear in parentheses. The percentage distribution for problem solving in technology-rich environments scale includes only those adults who took the problem solving in technology-rich environments assessment. Approximately 15 percent of the U.S. sample chose not to take the assessment on computer or were unable to do so and therefore did not take the problem solving in technology-rich environments assessment (see appendix C for more detailed information). Detail may not sum to totals because of rounding. Apparent differences between estimates may not be statistically significant. Some population groups did not have enough sample size to meet the minimum reporting standards.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Program for the International Assessment of Adult Competencies (PIAAC), U.S. PIAAC 2012/2014; Organization for Economic Cooperation and Development, PIAAC 2012.

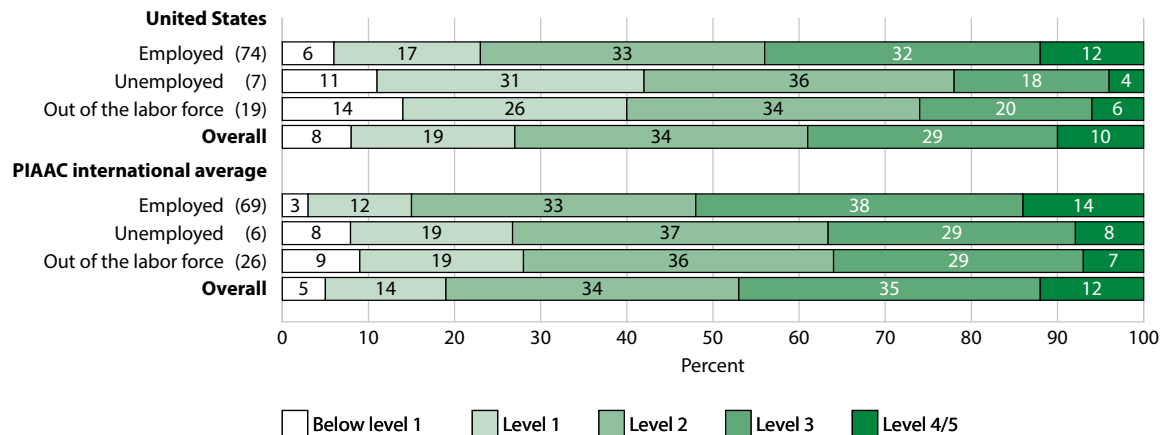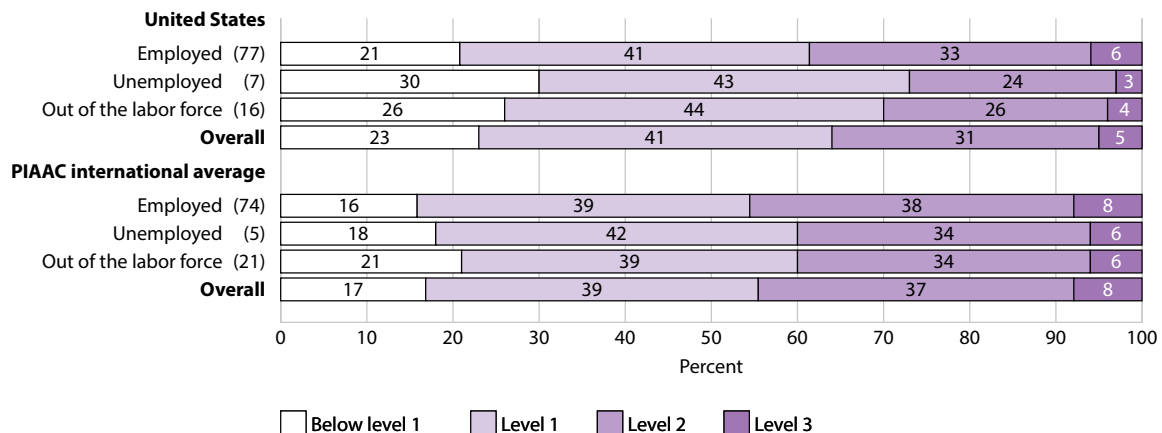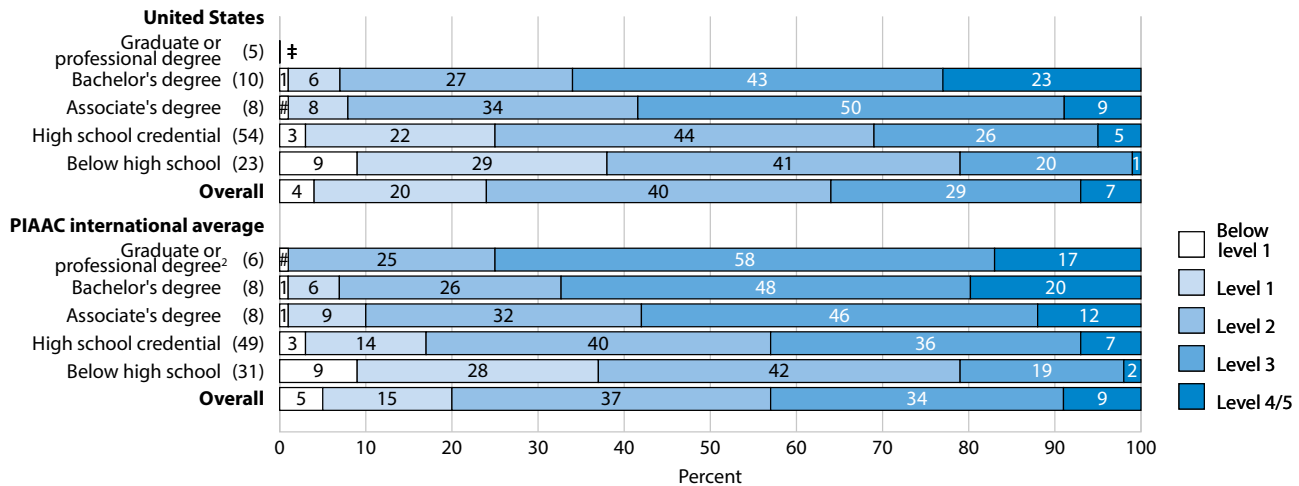**Figure 5-A.** Percentage of unemployed adults age 16 to 65 at each level of proficiency on the PIAAC literacy scale, by 10-year age intervals: 2012 and 2014[1]

United States

Age	Below level 1	Level 1	Level 2	Level 3	Level 4/5
16–24 (33)	2	20	41	30	8
25–34 (18)	3	19	41	31	6
35–44 (17)	5	21	42	25	7
45–54 (17)	5	20	43	27	6
55–65 (14)	8	21	31	31	8
Overall	4	20	40	29	7

PIAAC international average

Age	Below level 1	Level 1	Level 2	Level 3	Level 4/5
16–24 (28)	3	14	40	36	8
25–34 (24)	5	15	38	34	8
35–44 (20)	5	20	38	31	5
45–54 (17)	7	22	42	25	4
55–65 (11)	8	23	36	27	6
Overall	5	15	37	34	9

Percent

Figure 5-B. Percentage of unemployed adults age 16 to 65 at each level of proficiency on the PIAAC numeracy scale, by 10-year age intervals: 2012 and 2014[1]

United States

Age	Below level 1	Level 1	Level 2	Level 3	Level 4/5
16–24 (33)	10	32	36	18	4
25–34 (18)	10	29	40	17	4
35–44 (17)	13	34	30	17	5
45–54 (17)	11	30	39	16	4
55–65 (14)	13	25	33	24	5
Overall	11	31	36	18	4

PIAAC international average

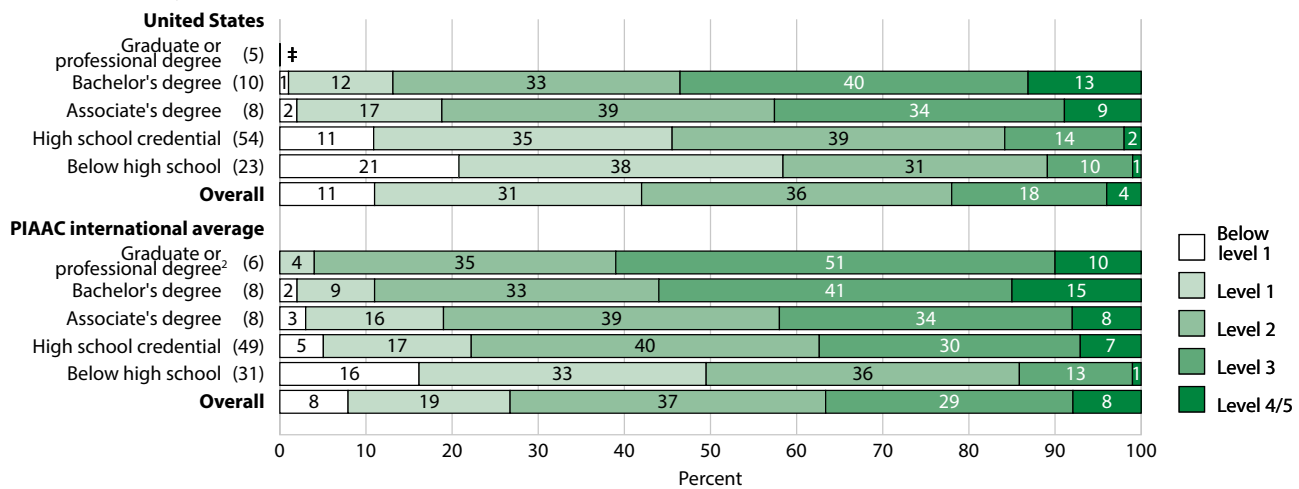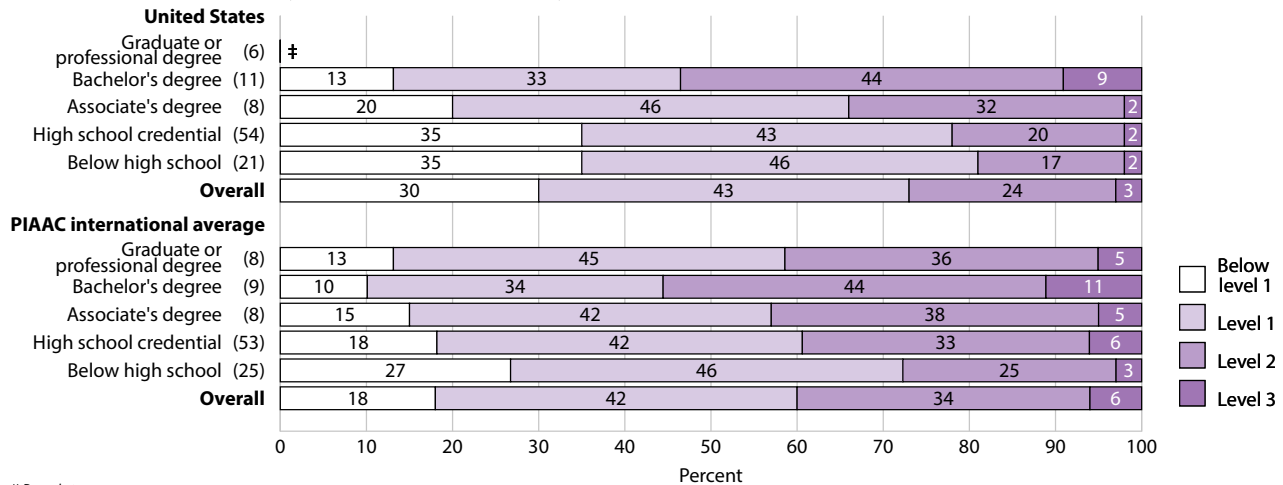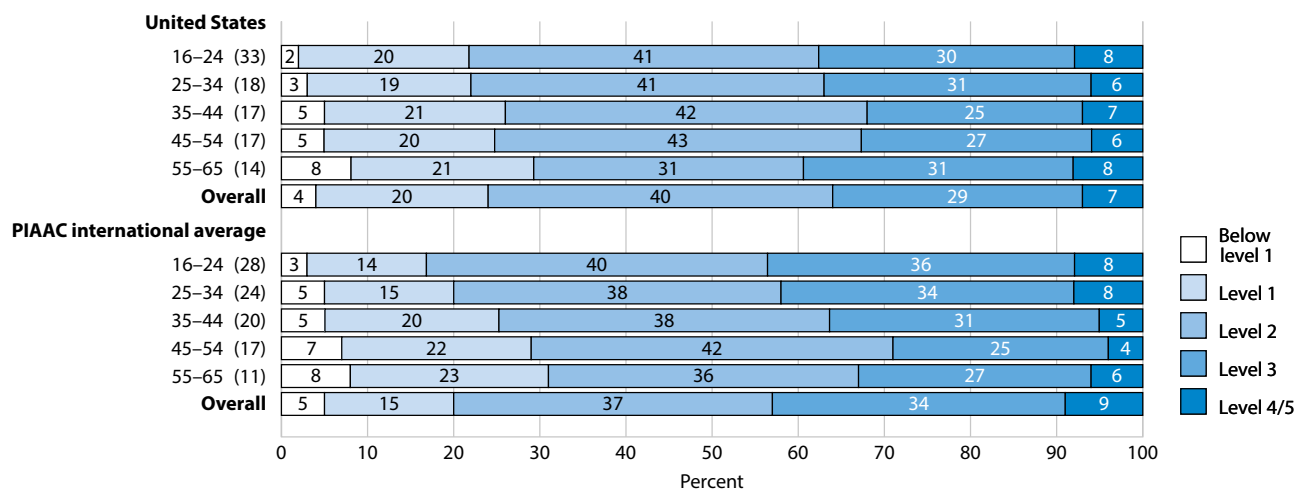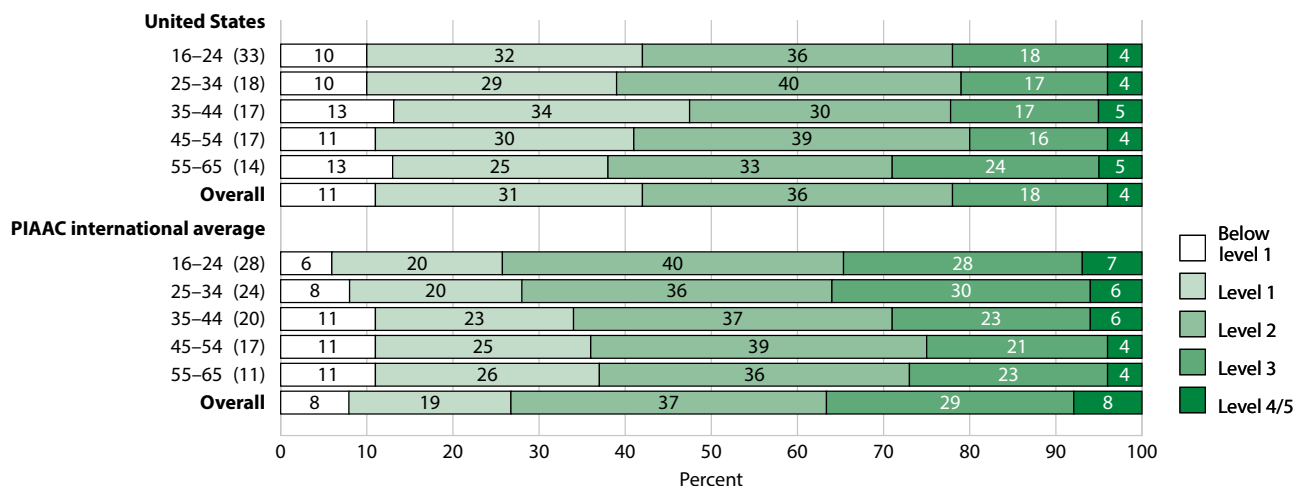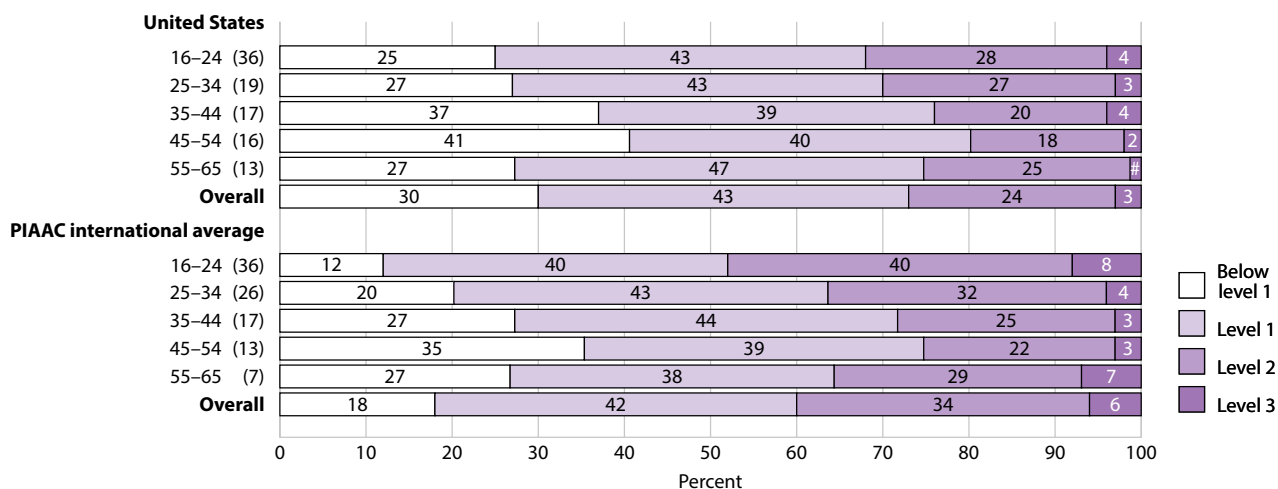| Age	Below level 1	Level 1	Level 2	Level 3	Level 4/5
16–24 (28)	6	20	40	28	7
25–34 (24)	8	20	36	30	6
35–44 (20)	11	23	37	23	6
45–54 (17)	11	25	39	21	4
55–65 (11)	11	26	36	23	4
Overall	8	19	37	29	8

Percent

Figure 5-C. Percentage of unemployed adults age 16 to 65 at each level of proficiency on the PIAAC problem solving in technology-rich environments scale, by 10-year age intervals: 2012 and 2014[1]

United States

Age	Below level 1	Level 1	Level 2	Level 3
16–24 (36)	25	43	28	4
25–34 (19)	27	43	27	3
35–44 (17)	37	39	20	4
45–54 (16)	41	40	18	2
55–65 (13)	27	47	25	#
Overall	30	43	24	3

PIAAC international average

Age	Below level 1	Level 1	Level 2	Level 3
16–24 (36)	12	40	40	8
25–34 (26)	20	43	32	4
35–44 (17)	27	44	25	3
45–54 (13)	35	39	22	3
55–65 (7)	27	38	29	7
Overall	18	42	34	6

Percent

Rounds to zero.

[1] United States data are the U.S. PIAAC 2012/2014 data. PIAAC international average is calculated from the U.S. PIAAC 2012/2014 data and international data from 2012 for all other countries shown in this report. Country- and region-specific results are available at http://nces.ed.gov/surveys/piaac/results/makeselections.aspx.

NOTE: Percentages of unemployed adults age 16 to 65 by 10-year age intervals appear in parentheses. The percentage distribution for problem solving in technology-rich environments scale includes only those adults who took the problem solving in technology-rich environments assessment. Approximately 15 percent of the U.S. sample chose not to take the assessment on computer or were unable to do so and therefore did not take the problem solving in technology-rich environments assessment (see appendix C for more detailed information). Detail may not sum to totals because of rounding. Apparent differences between estimates may not be statistically significant. Some population groups did not have enough sample size to meet the minimum reporting standards.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Program for the International Assessment of Adult Competencies (PIAAC), U.S. PIAAC 2012/2014; Organization for Economic Cooperation and Development, PIAAC 2012.

Figure 6-A. Percentage of unemployed adults age 16 to 65 at each level of proficiency on the PIAAC literacy scale, by gender: 2012 and 2014[1]
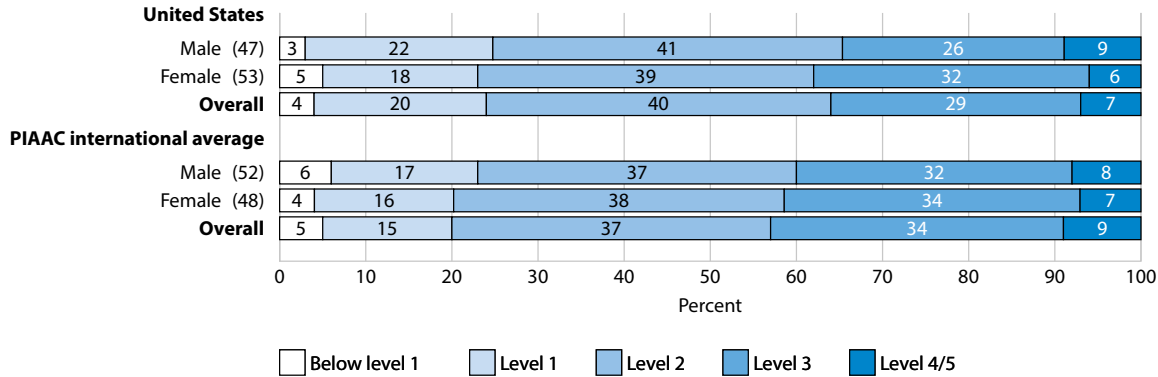
United States
	Below level 1	Level 1	Level 2	Level 3	Level 4/5
Male (47)	3	22	41	26	9
Female (53)	5	18	39	32	6
Overall	4	20	40	29	7

PIAAC international average
Male (52)	6	17	37	32	8
Female (48)	4	16	38	34	7
Overall	5	15	37	34	9

Percent (0 to 100)

Legend: ☐ Below level 1　☐ Level 1　☐ Level 2　☐ Level 3　☐ Level 4/5

Figure 6-B. Percentage of unemployed adults age 16 to 65 at each level of proficiency on the PIAAC numeracy scale, by gender: 2012 and 2014[1]

United States
	Below level 1	Level 1	Level 2	Level 3	Level 4/5
Male (47)	9	29	36	20	6
Female (53)	13	32	36	17	3
Overall	11	31	36	18	4

PIAAC international average
Male (52)	8	18	36	28	9
Female (48)	8	22	38	27	5
Overall	8	19	37	29	8

Percent (0 to 100)

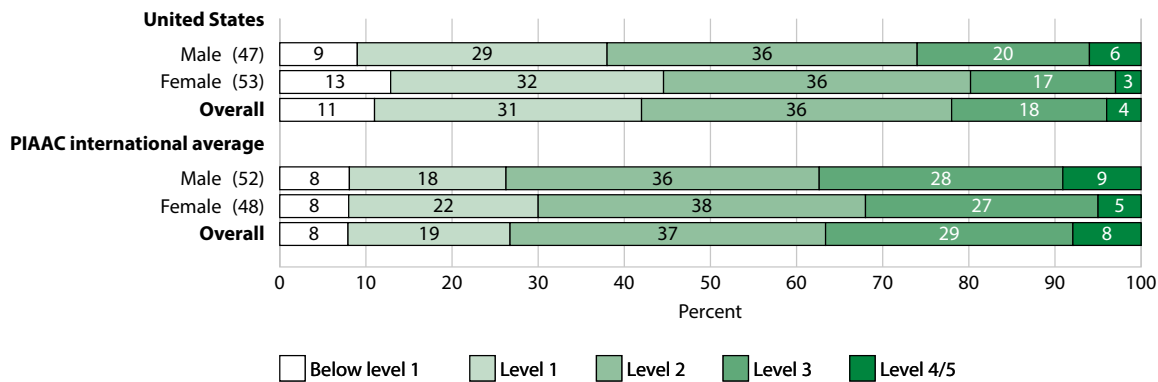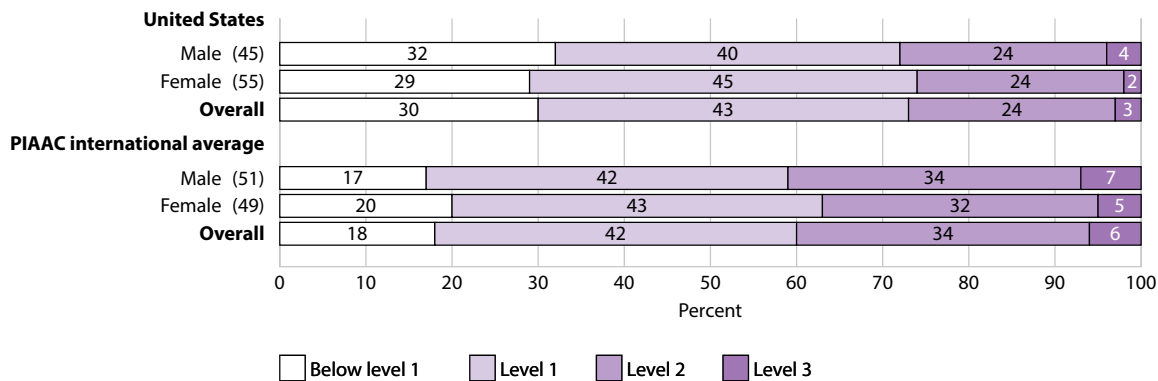Legend: ☐ Below level 1　☐ Level 1　☐ Level 2　☐ Level 3　☐ Level 4/5

Figure 6-C. Percentage of unemployed adults age 16 to 65 at each level of proficiency on the PIAAC problem solving in technology-rich environments scale, by gender: 2012 and 2014[1]

United States
	Below level 1	Level 1	Level 2	Level 3
Male (45)	32	40	24	4
Female (55)	29	45	24	2
Overall	30	43	24	3

PIAAC international average
Male (51)	17	42	34	7
Female (49)	20	43	32	5
Overall	18	42	34	6

Percent (0 to 100)

Legend: ☐ Below level 1　☐ Level 1　☐ Level 2　☐ Level 3

[1] United States data are the U.S. PIAAC 2012/2014 data. PIAAC international average is calculated from the U.S. PIAAC 2012/2014 data and international data from 2012 for all other countries shown in this report. Country- and region-specific results are available at http://nces.ed.gov/surveys/piaac/results/makeselections.aspx.
NOTE: Percentages of unemployed adults age 16 to 65 by gender appear in parentheses. The percentage distribution for problem solving in technology-rich environments scale includes only those adults who took the problem solving in technology-rich environments assessment. Approximately 15 percent of the U.S. sample chose not to take the assessment on computer or were unable to do so and therefore did not take the problem solving in technology-rich environments assessment (see appendix C for more detailed information). Detail may not sum to totals because of rounding. Apparent differences between estimates may not be statistically significant. Some population groups did not have enough sample size to meet the minimum reporting standards.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Program for the International Assessment of Adult Competencies (PIAAC), U.S. PIAAC 2012/2014; Organization for Economic Cooperation and Development, PIAAC 2012.

Figure 7-A. Percentage of unemployed U.S. adults age 16 to 65 at each level of proficiency on the PIAAC literacy scale, by race/ethnicity: 2012 and 2014

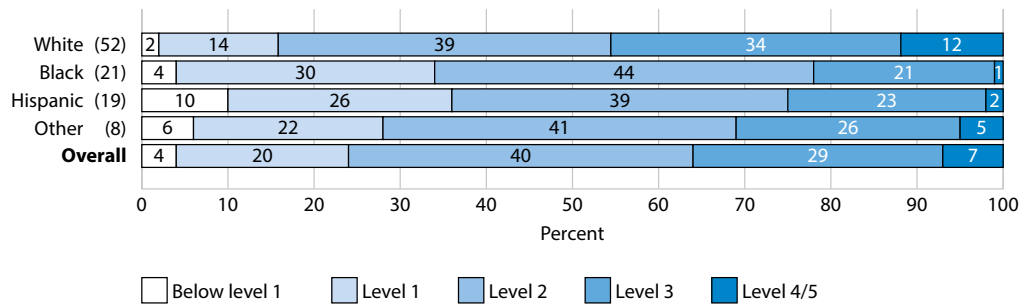|	Below level 1	Level 1	Level 2	Level 3	Level 4/5
White (52)	2	14	39	34	12
Black (21)	4	30	44	21	1
Hispanic (19)	10	26	39	23	2
Other (8)	6	22	41	26	5
Overall	4	20	40	29	7

Figure 7-B. Percentage of unemployed U.S. adults age 16 to 65 at each level of proficiency on the PIAAC numeracy scale, by race/ethnicity: 2012 and 2014

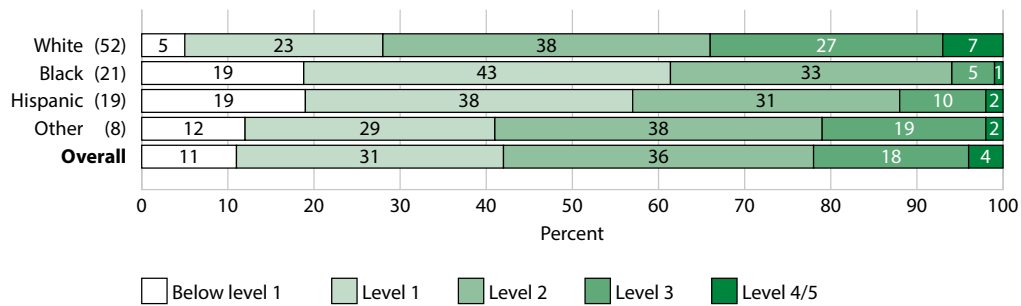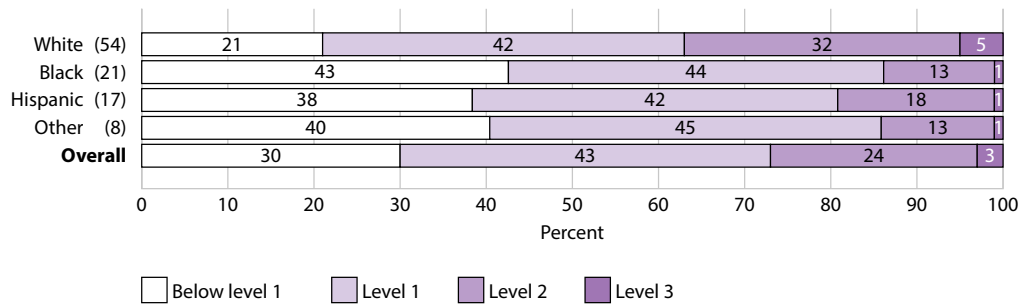|	Below level 1	Level 1	Level 2	Level 3	Level 4/5
White (52)	5	23	38	27	7
Black (21)	19	43	33	5	1
Hispanic (19)	19	38	31	10	2
Other (8)	12	29	38	19	2
Overall	11	31	36	18	4

Figure 7-C. Percentage of unemployed U.S. adults age 16 to 65 at each level of proficiency on the PIAAC problem solving in technology-rich environments scale, by race/ethnicity: 2012 and 2014

	Below level 1	Level 1	Level 2	Level 3
White (54)	21	42	32	5
Black (21)	43	44	13	1
Hispanic (17)	38	42	18	1
Other (8)	40	45	13	1
Overall	30	43	24	3

NOTE: United States data are the U.S. PIAAC 2012/2014 data. Percentages of unemployed U.S. adults age 16 to 65 by race/ethnicity appear in parentheses. The percentage distribution for problem solving in technology-rich environments scale includes only those adults who took the problem solving in technology-rich environments assessment. Approximately 15 percent of the U.S. sample chose not to take the assessment on computer or were unable to do so and therefore did not take the problem solving in technology-rich environments assessment (see appendix C for more detailed information). Black includes African American, and Hispanic includes Latino. Race categories exclude Hispanic origin. Detail may not sum to totals because of rounding. Apparent differences between estimates may not be statistically significant. Some population groups did not have enough sample size to meet the minimum reporting standards.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Program for the International Assessment of Adult Competencies (PIAAC), U.S. PIAAC 2012/2014; Organization for Economic Cooperation and Development, PIAAC 2012.

Young adults age 16 to 34

Figure 8-A. Percentage of adults age 16 to 34 at each level of proficiency on the PIAAC literacy scale, by highest level of educational attainment: 2012 and 2014[1]
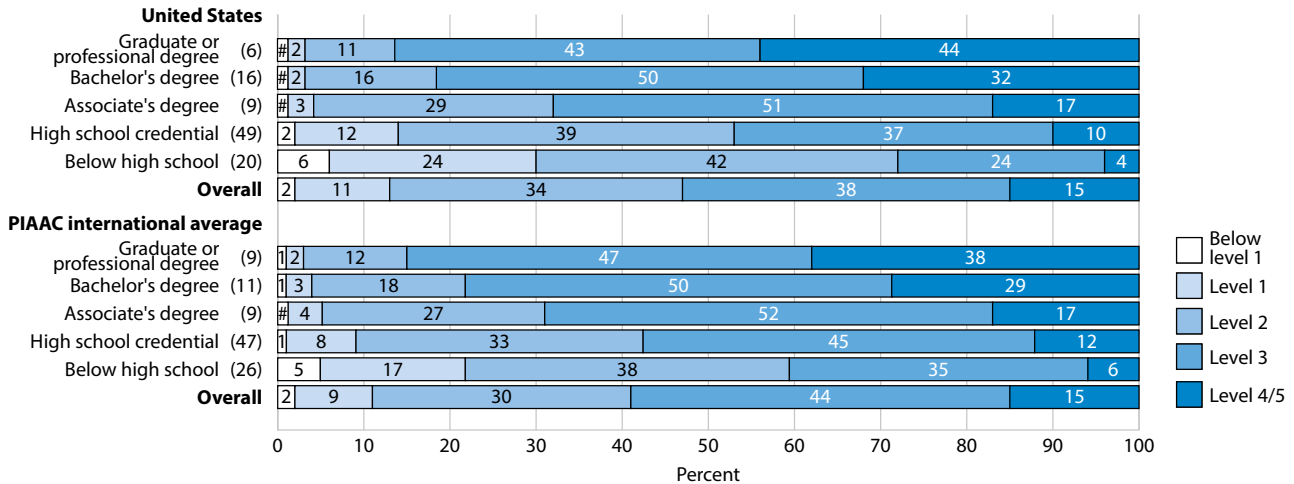

Figure 8-B. Percentage of adults age 16 to 34 at each level of proficiency on the PIAAC numeracy scale, by highest level of educational attainment: 2012 and 2014[1]
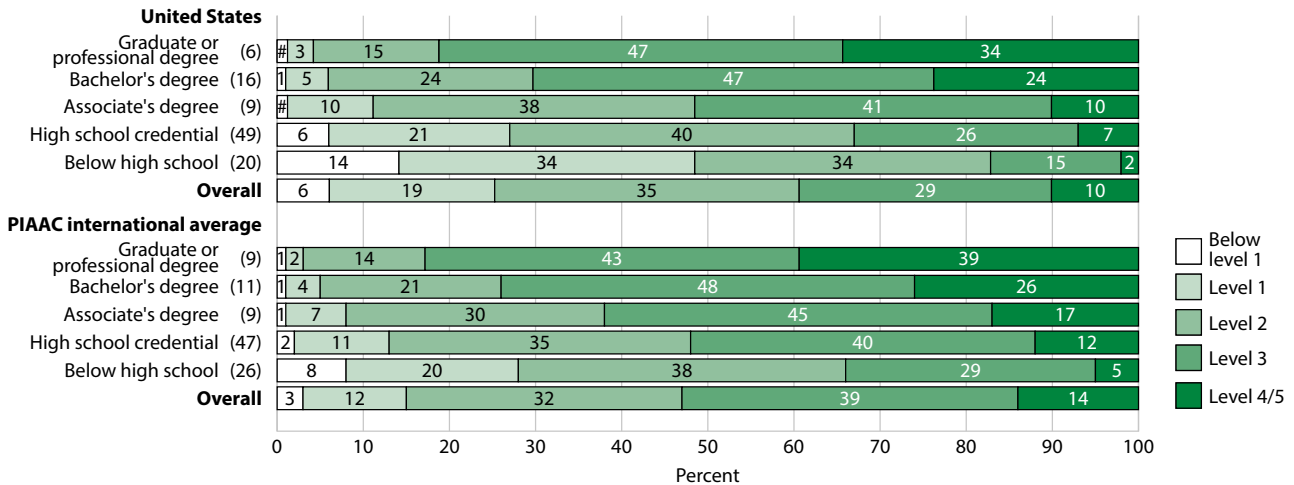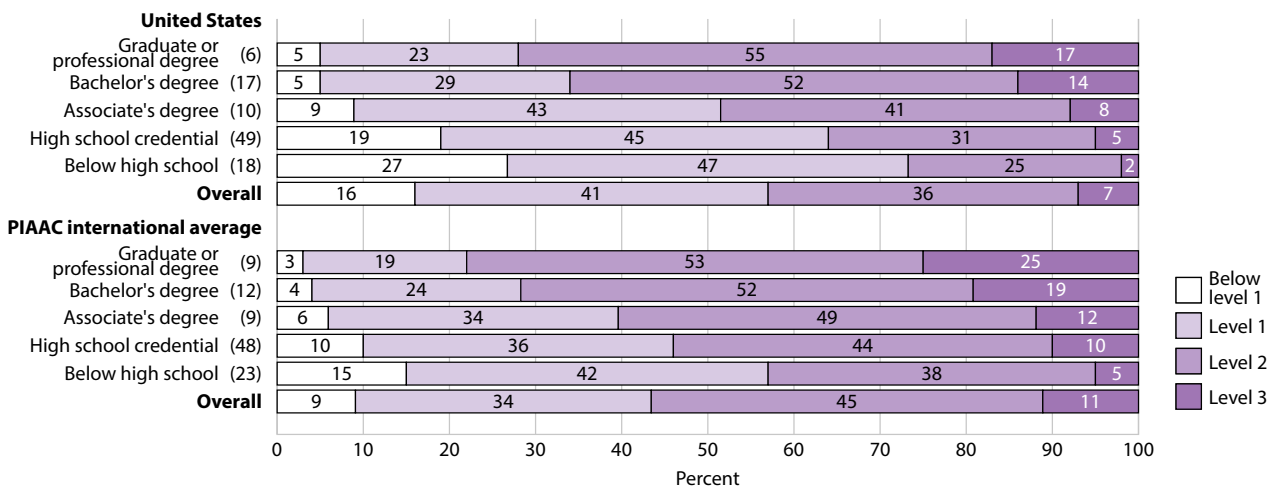

Figure 8-C. Percentage of adults age 16 to 34 at each level of proficiency on the PIAAC problem solving in technology-rich environments scale, by highest level of educational attainment: 2012 and 2014[1]

Rounds to zero.

[1] United States data are the U.S. PIAAC 2012/2014 data. PIAAC international average is calculated from the U.S. PIAAC 2012/2014 data and international data from 2012 for all other countries shown in this report. Country- and region-specific results are available at http://nces.ed.gov/surveys/piaac/results/makeselections.aspx.

NOTE: Percentages of adults age 16 to 34 by highest level of educational attainment appear in parentheses. The percentage distribution for problem solving in technology-rich environments scale includes only those adults who took the problem solving in technology-rich environments assessment. Approximately 15 percent of the U.S. sample chose not to take the assessment on computer or were unable to do so and therefore did not take the problem solving in technology-rich environments assessment (see appendix C for more detailed information). Detail may not sum to totals because of rounding. Apparent differences between estimates may not be statistically significant. Some population groups did not have enough sample size to meet the minimum reporting standards.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Program for the International Assessment of Adult Competencies (PIAAC), U.S. PIAAC 2012/2014; Organization for Economic Cooperation and Development, PIAAC 2012.

Figure 9-A. Percentage of U.S. adults age 16 to 34 at each level of proficiency on the PIAAC literacy scale, by race/ethnicity: 2012 and 2014
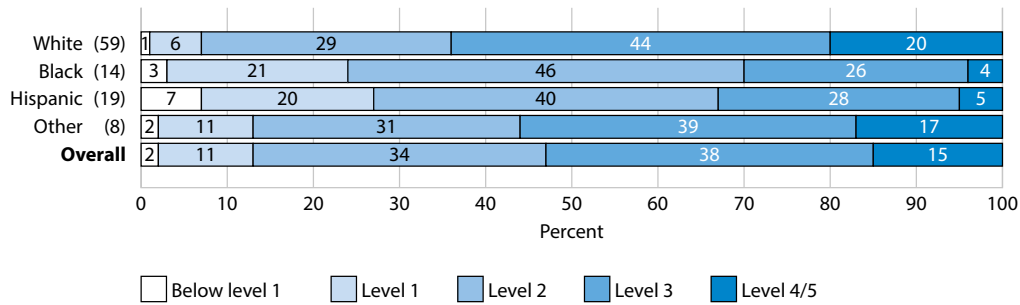
Race/ethnicity	Below level 1	Level 1	Level 2	Level 3	Level 4/5
White (59)	1	6	29	44	20
Black (14)	3	21	46	26	4
Hispanic (19)	7	20	40	28	5
Other (8)	2	11	31	39	17
Overall	2	11	34	38	15

Percent

Legend: Below level 1, Level 1, Level 2, Level 3, Level 4/5

Figure 9-B. Percentage of U.S. adults age 16 to 34 at each level of proficiency on the PIAAC numeracy scale, by race/ethnicity: 2012 and 2014

Race/ethnicity	Below level 1	Level 1	Level 2	Level 3	Level 4/5
White (59)	2	12	34	37	15
Black (14)	14	38	35	11	1
Hispanic (19)	12	30	37	18	3
Other (8)	5	14	34	34	13
Overall	6	19	35	29	10

Percent

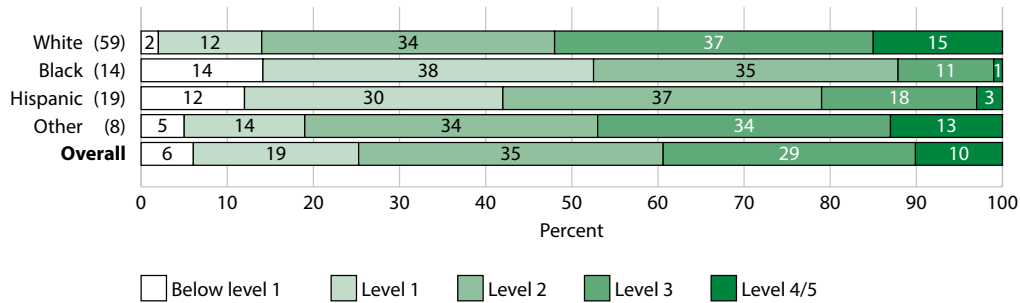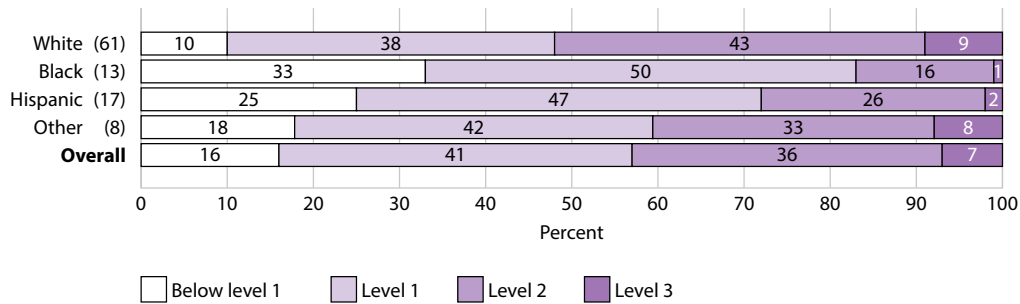Legend: Below level 1, Level 1, Level 2, Level 3, Level 4/5

Figure 9-C. Percentage of U.S. adults age 16 to 34 at each level of proficiency on the PIAAC problem solving in technology-rich environments scale, by race/ethnicity: 2012 and 2014

Race/ethnicity	Below level 1	Level 1	Level 2	Level 3
White (61)	10	38	43	9
Black (13)	33	50	16	1
Hispanic (17)	25	47	26	2
Other (8)	18	42	33	8
Overall	16	41	36	7

Percent

Legend: Below level 1, Level 1, Level 2, Level 3

NOTE: United States data are the U.S. PIAAC 2012/2014 data. Percentages of U.S. adults age 16 to 34 by race/ethnicity appear in parentheses. The percentage distribution for problem solving in technology-rich environments scale includes only those adults who took the problem solving in technology-rich environments assessment. Approximately 15 percent of the U.S. sample chose not to take the assessment on computer or were unable to do so and therefore did not take the problem solving in technology-rich environments assessment (see appendix C for more detailed information). Black includes African American, and Hispanic includes Latino. Race categories exclude Hispanic origin. Detail may not sum to totals because of rounding. Apparent differences between estimates may not be statistically significant. Some population groups did not have enough sample size to meet the minimum reporting standards.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Program for the International Assessment of Adult Competencies (PIAAC), U.S. PIAAC 2012/2014; Organization for Economic Cooperation and Development, PIAAC 2012.

Adults age 16 to 74

Figure 10-A. Percentage of U.S. adults age 16 to 74 at each level of proficiency on the PIAAC literacy scale, by 10-year age intervals: 2012 and 2014

Legend:
- Below level 1
- Level 1
- Level 2
- Level 3
- Level 4/5

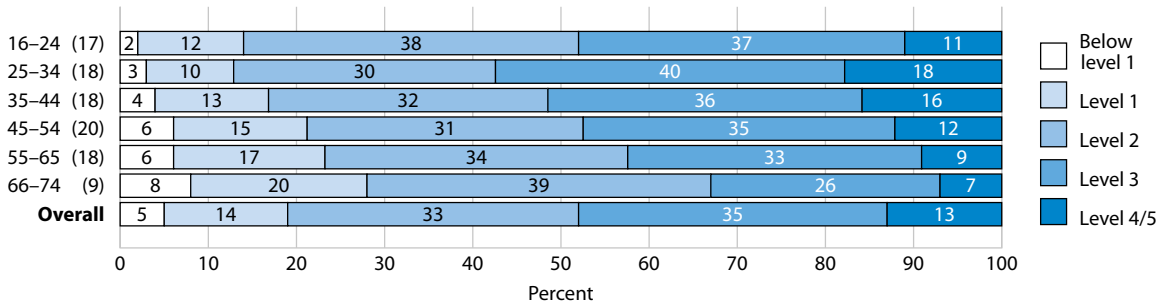| Age group	Below level 1	Level 1	Level 2	Level 3	Level 4/5
16–24 (17)	2	12	38	37	11
25–34 (18)	3	10	30	40	18
35–44 (18)	4	13	32	36	16
45–54 (20)	6	15	31	35	12
55–65 (18)	6	17	34	33	9
66–74 (9)	8	20	39	26	7
Overall	5	14	33	35	13

Percent

Figure 10-B. Percentage of U.S. adults age 16 to 74 at each level of proficiency on the PIAAC numeracy scale, by 10-year age intervals: 2012 and 2014

Legend:
- Below level 1
- Level 1
- Level 2
- Level 3
- Level 4/5

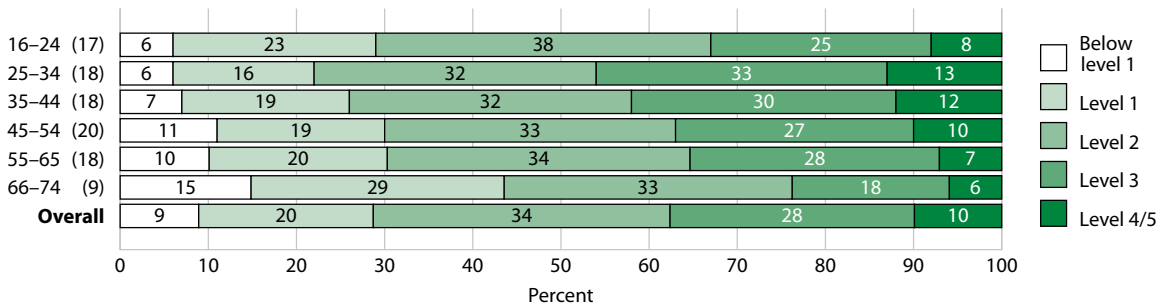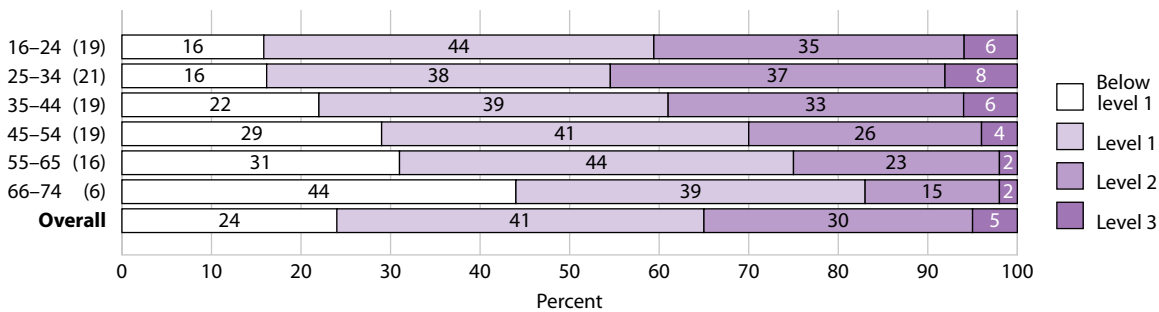| Age group	Below level 1	Level 1	Level 2	Level 3	Level 4/5
16–24 (17)	6	23	38	25	8
25–34 (18)	6	16	32	33	13
35–44 (18)	7	19	32	30	12
45–54 (20)	11	19	33	27	10
55–65 (18)	10	20	34	28	7
66–74 (9)	15	29	33	18	6
Overall	9	20	34	28	10

Percent

Figure 10-C. Percentage of U.S. adults age 16 to 74 at each level of proficiency on the PIAAC problem solving in technology-rich environments scale, by 10-year age intervals: 2012 and 2014

Legend:
- Below level 1
- Level 1
- Level 2
- Level 3

Age group	Below level 1	Level 1	Level 2	Level 3
16–24 (19)	16	44	35	6
25–34 (21)	16	38	37	8
35–44 (19)	22	39	33	6
45–54 (19)	29	41	26	4
55–65 (16)	31	44	23	2
66–74 (6)	44	39	15	2
Overall	24	41	30	5

Percent

NOTE: United States data are the U.S. PIAAC 2012/2014 data. Percentages of U.S. adults age 16 to 74 by 10-year age intervals appear in parentheses. The percentage distribution for problem solving in technology-rich environments scale includes only those adults who took the problem solving in technology-rich environments assessment. Approximately 15 percent of the U.S. sample chose not to take the assessment on computer or were unable to do so and therefore did not take the problem solving in technology-rich environments assessment (see appendix C for more detailed information). Detail may not sum to totals because of rounding. Apparent differences between estimates may not be statistically significant. Some population groups did not have enough sample size to meet the minimum reporting standards.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Program for the International Assessment of Adult Competencies (PIAAC), U.S. PIAAC 2012/2014; Organization for Economic Cooperation and Development, PIAAC 2012.

Older adults age 66 to 74

Figure 11-A. Percentage of U.S. adults age 66 to 74 at each level of proficiency on the PIAAC literacy scale, by highest level of educational attainment: 2014
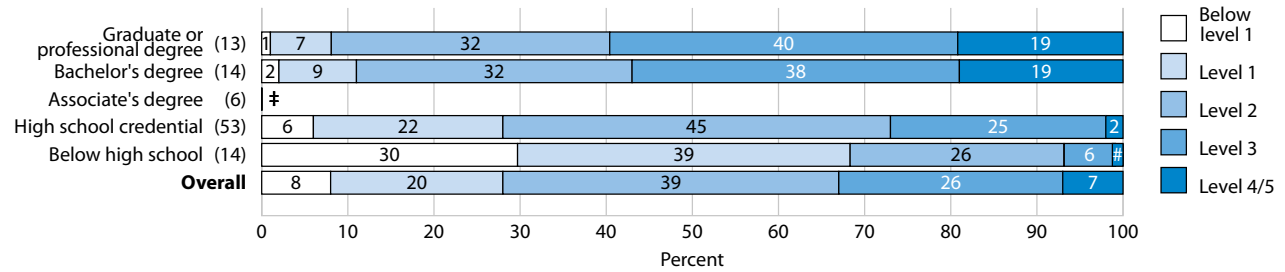
		Below level 1	Level 1	Level 2	Level 3	Level 4/5
Graduate or professional degree	(13)	1	7	32	40	19
Bachelor's degree	(14)	2	9	32	38	19
Associate's degree	(6)	‡				
High school credential	(53)	6	22	45	25	2
Below high school	(14)	30	39	26	6	#
Overall		8	20	39	26	7

Percent

Figure 11-B. Percentage of U.S. adults age 66 to 74 at each level of proficiency on the PIAAC numeracy scale, by highest level of educational attainment: 2014

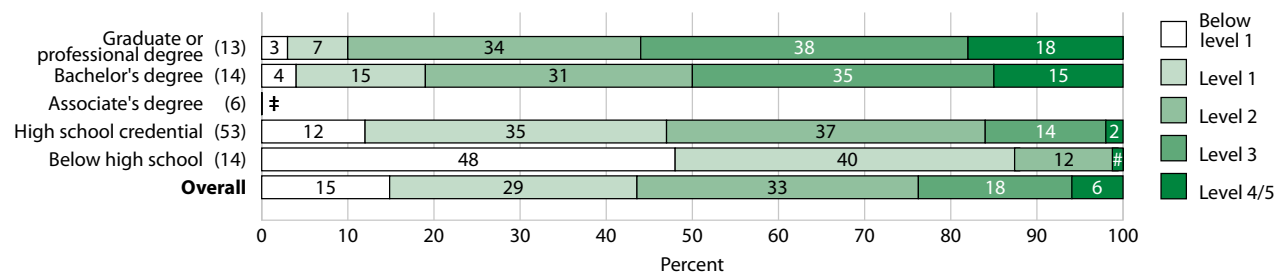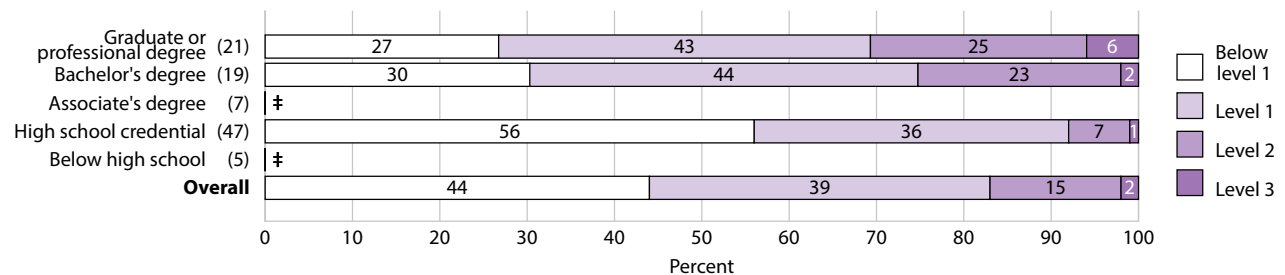|		Below level 1	Level 1	Level 2	Level 3	Level 4/5
Graduate or professional degree	(13)	3	7	34	38	18
Bachelor's degree	(14)	4	15	31	35	15
Associate's degree	(6)	‡				
High school credential	(53)	12	35	37	14	2
Below high school	(14)	48	40	12	#	
Overall		15	29	33	18	6

Percent

Figure 11-C. Percentage of U.S. adults age 66 to 74 at each level of proficiency on the PIAAC problem solving in technology-rich environments scale, by highest level of educational attainment: 2014

		Below level 1	Level 1	Level 2	Level 3
Graduate or professional degree	(21)	27	43	25	6
Bachelor's degree	(19)	30	44	23	2
Associate's degree	(7)	‡			
High school credential	(47)	56	36	7	1
Below high school	(5)	‡			
Overall		44	39	15	2

Percent

Rounds to zero.

‡ Reporting standards not met. Sample size insufficient to permit a reliable estimate.

NOTE: Percentages of U.S. adults age 66 to 74 by highest level of educational attainment appear in parentheses. The percentage distribution for problem solving in technology-rich environments scale includes only those adults who took the problem solving in technology-rich environments assessment. Approximately 15 percent of the U.S. sample chose not to take the assessment on computer or were unable to do so and therefore did not take the problem solving in technology-rich environments assessment (see appendix C for more detailed information). Detail may not sum to totals because of rounding. Apparent differences between estimates may not be statistically significant. Some population groups did not have enough sample size to meet the minimum reporting standards.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Program for the International Assessment of Adult Competencies (PIAAC), U.S. National Supplement, 2014.

Figure 12-A. Percentage of U.S. adults age 66 to 74 at each level of proficiency on the PIAAC literacy scale, by employment status: 2014
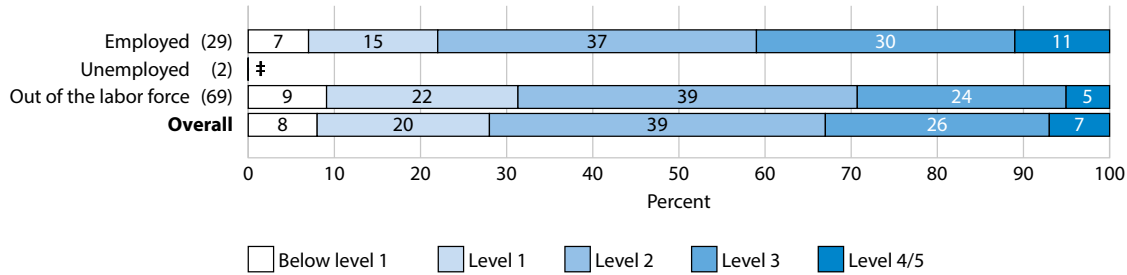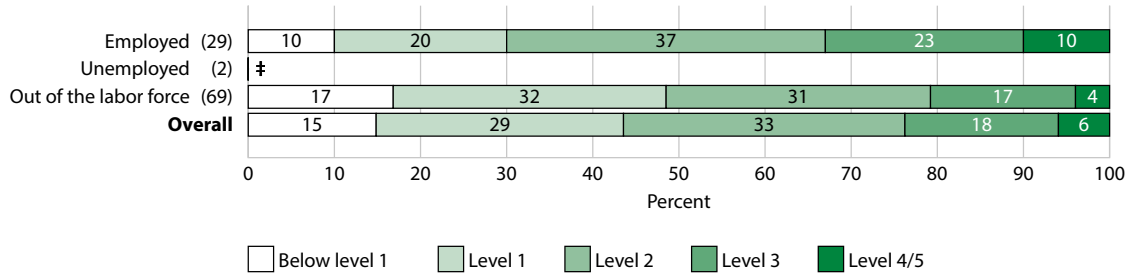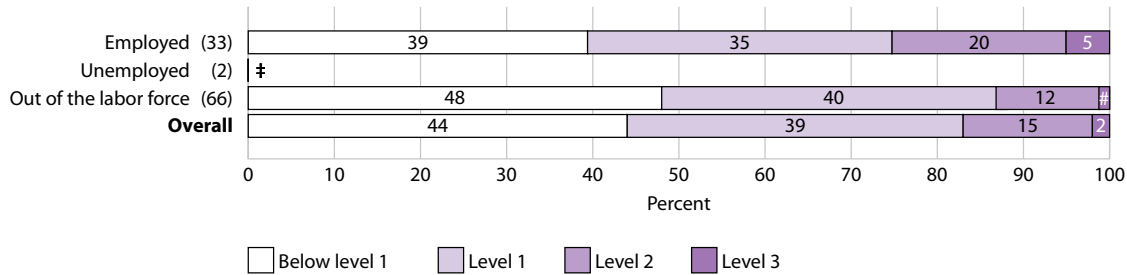
Employment status	Below level 1	Level 1	Level 2	Level 3	Level 4/5
Employed (29)	7	15	37	30	11
Unemployed (2)	‡				
Out of the labor force (69)	9	22	39	24	5
Overall	8	20	39	26	7

Percent

Legend: ☐ Below level 1 ☐ Level 1 ☐ Level 2 ☐ Level 3 ☐ Level 4/5

Figure 12-B. Percentage of U.S. adults age 66 to 74 at each level of proficiency on the PIAAC numeracy scale, by employment status: 2014

Employment status	Below level 1	Level 1	Level 2	Level 3	Level 4/5
Employed (29)	10	20	37	23	10
Unemployed (2)	‡				
Out of the labor force (69)	17	32	31	17	4
Overall	15	29	33	18	6

Percent

Legend: ☐ Below level 1 ☐ Level 1 ☐ Level 2 ☐ Level 3 ☐ Level 4/5

Figure 12-C. Percentage of U.S. adults age 66 to 74 at each level of proficiency on the PIAAC problem solving in technology-rich environments scale, by employment status: 2014

Employment status	Below level 1	Level 1	Level 2	Level 3
Employed (33)	39	35	20	5
Unemployed (2)	‡			
Out of the labor force (66)	48	40	12	#
Overall	44	39	15	2

Percent

Legend: ☐ Below level 1 ☐ Level 1 ☐ Level 2 ☐ Level 3

\# Rounds to zero.

‡ Reporting standards not met. Sample size insufficient to permit a reliable estimate.

NOTE: Percentages of U.S. adults age 66 to 74 by employment status appear in parentheses. The percentage distribution for problem solving in technology-rich environments scale includes only those adults who took the problem solving in technology-rich environments assessment. Approximately 15 percent of the U.S. sample chose not to take the assessment on computer or were unable to do so and therefore did not take the problem solving in technology-rich environments assessment (see appendix C for more detailed information). The unemployed comprise all persons above a specified age who during the reference period were in the following categories: without work, that is, were not in paid employment or self-employment during the reference period; currently available for work, that is, were available for paid employment or self-employment during the reference period; and seeking work, that is, had taken specific steps in a specified recent period to seek paid employment or self-employment. Out of the labor forces comprise all persons not classified as either employed or unemployed. Detail may not sum to totals because of rounding. Apparent differences between estimates may not be statistically significant. Some population groups did not have enough sample size to meet the minimum reporting standards.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Program for the International Assessment of Adult Competencies (PIAAC), U.S. National Supplement, 2014.

Figure 13-A. Percentage of U.S. adults age 66 to 74 at each level of proficiency on the PIAAC literacy scale, by self-reported health status: 2014
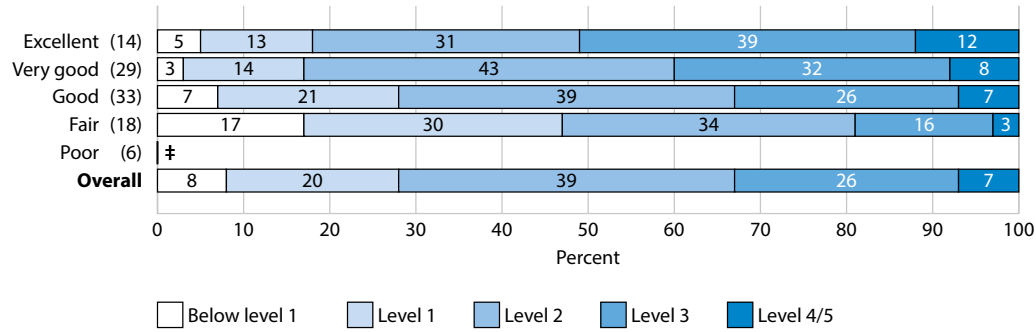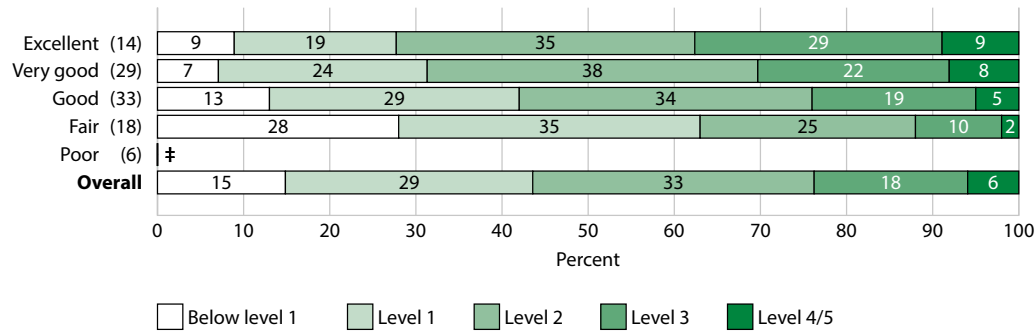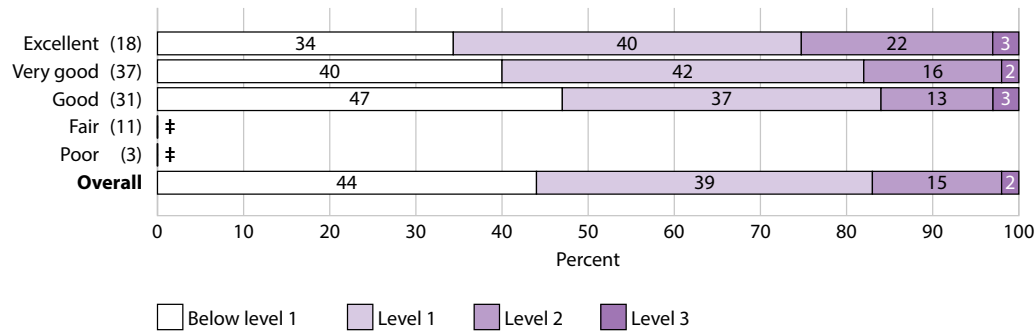
Health status	Below level 1	Level 1	Level 2	Level 3	Level 4/5
Excellent (14)	5	13	31	39	12
Very good (29)	3	14	43	32	8
Good (33)	7	21	39	26	7
Fair (18)	17	30	34	16	3
Poor (6)	‡				
Overall	8	20	39	26	7

Percent

Legend: ☐ Below level 1 ☐ Level 1 ☐ Level 2 ☐ Level 3 ☐ Level 4/5

Figure 13-B. Percentage of U.S. adults age 66 to 74 at each level of proficiency on the PIAAC numeracy scale, by self-reported health status: 2014

Health status	Below level 1	Level 1	Level 2	Level 3	Level 4/5
Excellent (14)	9	19	35	29	9
Very good (29)	7	24	38	22	8
Good (33)	13	29	34	19	5
Fair (18)	28	35	25	10	2
Poor (6)	‡				
Overall	15	29	33	18	6

Percent

Legend: ☐ Below level 1 ☐ Level 1 ☐ Level 2 ☐ Level 3 ☐ Level 4/5

Figure 13-C. Percentage of U.S. adults age 66 to 74 at each level of proficiency on the PIAAC problem solving in technology-rich environments scale, by self-reported health status: 2014

Health status	Below level 1	Level 1	Level 2	Level 3
Excellent (18)	34	40	22	3
Very good (37)	40	42	16	2
Good (31)	47	37	13	3
Fair (11)	‡			
Poor (3)	‡			
Overall	44	39	15	2

Percent

Legend: ☐ Below level 1 ☐ Level 1 ☐ Level 2 ☐ Level 3

‡ Reporting standards not met. Sample size insufficient to permit a reliable estimate.
NOTE: Percentages of U.S. adults age 66 to 74 by self-reported health status appear in parentheses. The percentage distribution for problem solving in technology-rich environments scale includes only those adults who took the problem solving in technology-rich environments assessment. Approximately 15 percent of the U.S. sample chose not to take the assessment on computer or were unable to do so and therefore did not take the problem solving in technology-rich environments assessment (see appendix C for more detailed information). Detail may not sum to totals because of rounding. Apparent differences between estimates may not be statistically significant. Some population groups did not have enough sample size to meet the minimum reporting standards.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Program for the International Assessment of Adult Competencies (PIAAC), U.S. National Supplement, 2014.

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More Information About PIAAC

This report provides findings for only a few selected results. Readers may also

- preview and print a selection of data on the performance of U.S. adults on the PIAAC assessment for various topics across all three domains at http://nces.ed.gov/surveys/piaac/index.asp;

- find more information about the international results at http://www.oecd.org/site/piaac/;

- explore U.S. PIAAC data in the NCES International Data Explorer (IDE) at http://nces.ed.gov/surveys/international/ide/;

- access public-use data files that are available at http://nces.ed.gov/surveys/piaac/index.asp; and

- access restricted-use data files that are available to NCES Restricted-use Data Licensees. More information on licenses can be found at http://nces.ed.gov/pubsearch/licenses.asp.

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Appendix A: Members of the PIAAC Subject Matter Expert Groups

This appendix lists the members of the four expert groups responsible for developing the frameworks for the PIAAC content domains.

Literacy Expert Group

Stan Jones (Chair), Canada
Egil Gabrielsen, Center for Reading Research, University of Stavanger, Norway
Jan Hagston, Australia
Pirjo Linnakylä, University of Jyväskylä, Finland
Hakima Megherbi, University of Paris, France
John Sabatini, Educational Testing Service, United States of America
Monika Tröster, German Institute for Adult Education, Germany
Eduardo Vidal-Abarca, Department of Psychology, University of Valencia, Spain

Numeracy Expert Group

Iddo Gal (Chair), University of Haifa, Israel
Silvia Alatorre, National Pedagogical University, Mexico
Sean Close, St. Patrick's College, Ireland
Jeff Evans, Middlesex University, United Kingdom
Lene Johansen, Aalborg University, Denmark
Terry Maguire, Institute of Technology Tallaght-Dublin, Ireland
Myrna Manly, United States of America
Dave Tout, Australian Council for Educational Research, Australia

Problem Solving in Technology-Rich Environments Expert Group

Jean-François Rouet (Chair), National Center for Scientific Research (CNRS) and University of Poitiers, France
Mirelle Bétrancourt, University of Geneva, Switzerland
M. Anne Britt, Northern Illinois University, United States of America
Dr. Rainer Bromme, University of Muenster, Germany
Arthur C. Graesser, University of Memphis, United States of America
Jonna M. Kulikowich, Pennsylvania State University, United States of America
Donald J. Leu, University of Connecticut, United States of America
Naoki Ueno, Musashi Institute of Technology, Japan
Herre van Oostendorp, Utrecht University, Netherlands

Reading Components Expert Group

John Sabatini, Educational Testing Service, United States of America
Kelly M. Bruce, Educational Testing Service, United States of America

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Appendix B: PIAAC Scales and Proficiency-Level Descriptions

This appendix describes in more detail the PIAAC scales and the proficiency-level descriptions that accompany these scales. PIAAC proficiency results are also reported in terms of the percentages of adults performing at or "reaching" each of the proficiency levels.

Overview

PIAAC defines four core competency domains of adult cognitive skills that are seen as key to facilitating the social and economic participation of adults in advanced economies:

- Literacy;
- Reading components;
- Numeracy; and
- Problem solving in technology-rich environments.

As described in appendix C, PIAAC is administered in either paper-and-pencil mode or via computer interface. Literacy and numeracy are offered in both paper-and-pencil and computer modes. Reading components, which are designed to provide information about the literacy skills of adults at the lower end of the literacy spectrum, are offered only in paper-and-pencil mode. Problem solving in technology-rich environments is administered via computer only.

The OECD oversees the work of several teams of experts in the development of assessment frameworks in each of the domains (see appendix A). Assessment frameworks are available at http://www.oecd.org/site/piaac/publications.htm. Information about the item development and proficiency level setting process will be included in a forthcoming PIAAC technical report from OECD.

Literacy

The PIAAC literacy framework expands on the definition of literacy previously used in IALS and ALL. PIAAC broadly defines literacy as "*understanding, evaluating, using and engaging with written text to participate in society, to achieve one's goals and to develop one's knowledge and potential*" (OECD 2012).

The purpose of this expanded definition is to highlight the ranges of cognitive processes involved in literacy, focus on a more active role of individuals in society, and include various text types, both in print and electronic formats, in the measurement of literacy.

PIAAC items include continuous texts (e.g., text in sentences and paragraphs), noncontinuous texts (e.g., schedules, graphs, and maps), and electronic texts (including hypertext or text in interactive environments, such as forms and blogs). Task activities are presented in home, work, and community contexts, addressing various purposes adults pursue in their everyday lives.

Based on the PIAAC framework, literacy tasks include items in paper-and-pencil and computer-based delivery modes that cover a range of difficulties—low, middle, and high—to present a comprehensive picture of the level of adult literacy skills in each country or region.

Reading components

The primary goal of the PIAAC reading components is to provide information about the literacy skills of adults at the lower end of the literacy spectrum—specifically, whether they have the foundational skills to develop the higher literacy and numeracy abilities necessary to function in society.

The reading components assessment focuses on elements of reading that are comparable across the range of languages in the participating countries and regions: reading vocabulary, sentence comprehension, and basic passage comprehension.

- The **reading vocabulary** section asks participants to identify the best word that should be used to label different graphic illustrations. This task measures whether participants can identify common, concrete print words used in everyday adult interactions in the community, home, and workplace. It is not meant to determine the vocabulary knowledge (breadth or depth) of the participants.
- The **sentence comprehension** section asks participants to identify whether sentences of varying grammatical/syntactic complexity make sense. This task measures whether participants can understand and correctly judge the accuracy of the content of sentences.
- The **basic passage comprehension** section asks participants to make a choice between a correct and an incorrect word to complete a sentence within a passage. This task measures whether respondents comprehend text in context and can appropriately use words in ways that characterize fluency.

The reading component portion of the assessment is optional for countries and regions participating in PIAAC. In countries and regions that adopt the reading components tasks, participants who decide not to take the computer-based assessment, and those who fail to pass the computer-administered information and communication technology (ICT) skills and literacy/numeracy "Core" items, are directed to the reading components tasks. (Additional information about the administration of the assessment and the "Core" items can be found in appendix C.) Data from the reading components portion of the assessment are not reported separately in this report, but can be accessed from the International Data Explorer (IDE) at http://www.oecd.org/site/piaac/publicdataandanalysis.htm.

Exhibit B-1. Description of PIAAC proficiency levels on the literacy scale

Proficiency levels and cut scores for literacy	Literacy task descriptions
Level 5 **(376 – 500)**	At this level, tasks may require the respondent to search for and integrate information across multiple, dense texts; construct syntheses of similar and contrasting ideas or points of view; or evaluate evidence-based arguments. Application and evaluation of logical and conceptual models of ideas may be required to accomplish tasks. Evaluating reliability of evidentiary sources and selecting key information is frequently a requirement. Tasks often require respondents to be aware of subtle, rhetorical cues and to make high-level inferences or use specialized background knowledge.
Level 4 **(326 – 375)**	Tasks at this level often require respondents to perform multiple-step operations to integrate, interpret, or synthesize information from complex or lengthy continuous, non-continuous, mixed, or multiple type texts. Complex inferences and application of background knowledge may be needed to perform the task successfully. Many tasks require identifying and understanding one or more specific, non-central idea(s) in the text in order to interpret or evaluate subtle evidence-claim or persuasive discourse relationships. Conditional information is frequently present in tasks at this level and must be taken into consideration by the respondent. Competing information is present and sometimes seemingly as prominent as correct information.
Level 3 **(276 – 325)**	Texts at this level are often dense or lengthy, and include continuous, non-continuous, mixed, or multiple pages of text. Understanding text and rhetorical structures become more central to successfully completing tasks, especially navigating complex digital texts. Tasks require the respondent to identify, interpret, or evaluate one or more pieces of information, and often require varying levels of inference. Many tasks require the respondent to construct meaning across larger chunks of text or perform multi-step operations in order to identify and formulate responses. Often tasks also demand that the respondent disregard irrelevant or inappropriate content to answer accurately. Competing information is often present, but it is not more prominent than the correct information.
Level 2 **(226 – 275)**	At this level, the medium of texts may be digital or printed, and texts may comprise continuous, non-continuous, or mixed types. Tasks at this level require respondents to make matches between the text and information, and may require paraphrasing or low-level inferences. Some competing pieces of information may be present. Some tasks require the respondent to • cycle through or integrate two or more pieces of information based on criteria; • compare and contrast or reason about information requested in the question; or • navigate within digital texts to access and identify information from various parts of a document.
Level 1 **(176 – 225)**	Most of the tasks at this level require the respondent to read relatively short digital or print continuous, non-continuous, or mixed texts to locate a single piece of information that is identical to or synonymous with the information given in the question or directive. Some tasks, such as those involving non-continuous texts, may require the respondent to enter personal information onto a document. Little, if any, competing information is present. Some tasks may require simple cycling through more than one piece of information. Knowledge and skill in recognizing basic vocabulary, determining the meaning of sentences, and reading paragraphs of text is expected.
Below Level 1 **(0 – 175)**	The tasks at this level require the respondent to read brief texts on familiar topics to locate a single piece of specific information. There is seldom any competing information in the text and the requested information is identical in form to information in the question or directive. The respondent may be required to locate information in short continuous texts. However, in this case, the information can be located as if the text were non-continuous in format. Only basic vocabulary knowledge is required, and the reader is not required to understand the structure of sentences or paragraphs or make use of other text features. Tasks below level 1 do not make use of any features specific to digital texts.

Exhibit B-2. Examples of literacy items

Items that exemplify the pertinent features of the proficiency levels in the domain of literacy are described below. In order to be consistent with the OECD international report, Levels 4 and 5 are combined in the figures in this report (Level 4/5).

Level 4: Library search (Item ID: C323P002)
Difficulty score: 348

The stimulus displays results from a bibliographic search from a simulated library website. The test-taker is asked to identify a book suggesting that the claims made both for and against genetically modified foods are unreliable. He or she needs to read the title and the description of each book in each of the entries reporting the results of the bibliographic search in order to identify the correct book. Many pieces of distracting information are present. The information that the relevant book suggests that the claims for and against genetically modified foods are unreliable must be inferred from the truncated Internet search result stating that the author "describes how both sides in this hotly contested debate have manufactured propaganda, tried to dupe the public and…[text ends with ellipsis as shown]".

Level 3: Library search (Item ID: C323P003)
Difficulty score: 289

This task uses the same stimulus as the previous example. The test-taker is asked to identify the name of the author of a book called *Ecomyth*. To complete the task, the test-taker has to scroll through a list of bibliographic entries and find the name of the author specified under the book title. In addition to scrolling, the test-taker must be able to access the second page where *Ecomyth* is located by either clicking the page number (2) or the word "next". There is considerable irrelevant information in each entry to this particular task, which adds to the complexity of the task.

Level 2: Lakeside fun run (Item ID: C322P002)
Difficulty score: 240

The stimulus is a simulated website containing information about the annual fun run/walk organized by the Lakeside community club. The test-taker is first directed to a page with several links, including "Contact Us" and "FAQs". He or she is then asked to identify the link providing the phone number of organizers of the event. In order to answer this item correctly, the test-taker needs to click on the link "Contact Us". This requires navigating through a digital text and some understanding of web conventions. While this task might be fairly simple for test-takers familiar with web-based texts, some respondents less familiar with web-based texts would need to make some inferences to identify the correct link.

Level 1: Generic medicine (Item ID: C309A321)
Difficulty score: 219

The stimulus is a short newspaper article entitled "Generic medicines: Not for the Swiss". It has two paragraphs and a table in the middle displaying the market share of generic medicines in 14 European countries and the United States. The test-taker is asked to determine the number of countries in which the generic drug market accounts for 10 percent or more of total drug sales. The test-taker has to count the number of countries with a market share greater than 10 percent. The percentages are sorted in descending order to facilitate the search. The phrase "drug sales", however, does not appear in the text; therefore, the test-taker needs to understand that "market share" is a synonym for "drug sales" in order to answer the question.

Below Level 1: Election results (Item ID: C302BC02)
Difficulty score: 162

The stimulus consists of a short report of the results of a union election containing several brief paragraphs and a simple table identifying the three candidates in the election and the number of votes they received. The test-taker is asked to identify which candidate received the fewest votes. He or she needs to compare the number of votes that the three candidates received and identify the name of the candidate who received the fewest votes. The word "votes" appears in both the question and in the table and nowhere else in the text.

Numeracy

The primary goal of PIAAC's numeracy assessment is to evaluate basic mathematical and computational skills that are considered fundamental for functioning in everyday work and social life. Numeracy in the PIAAC framework is defined as "*the ability to access, use, interpret, and communicate mathematical information and ideas, to engage in and manage mathematical demands of a range of situations in adult life*" (OECD 2012).

The PIAAC numeracy domain is built on previous large-scale assessments of this domain, school-oriented assessments, and a review of requirements of workplace skills, adult learning, and mathematics and statistics education. The tasks that measure this domain involve managing a situation or solving a problem in a practical context—in home, work, or community settings. These tasks ask respondents to work with numbers, proportions, measurements, and statistical concepts, and then call for participants to compute, interpret, and communicate the results and mathematical content. The situations and problems presented in these tasks involve objects or pictures, text, numbers, graphs, and technology-based displays. They also require basic mathematical skills in computation, proportions and percentages, an understanding of measurement concepts and procedures, and working with simple formulas. Respondents also encounter more complex items that require using models to predict future needs, and an understanding of basic statistical concepts and displays.

In addition, PIAAC numeracy assessment items

- are set in authentic and culturally appropriate contexts;
- measure different levels of ability; and
- use the standard measuring systems of the participating country or region.

Numeracy tasks include items in paper-and-pencil and computer-based delivery modes that cover a range of difficulties—low, middle, and high—to present a comprehensive picture of the level of adult numeracy skills in each country or region.

Exhibit B-3. Description of PIAAC proficiency levels on the numeracy scale

Proficiency levels and cut scores for numeracy	Numeracy task descriptions
Level 5 **(376 – 500)**	Tasks at this level require the respondent to understand complex representations and abstract and formal mathematical and statistical ideas, possibly embedded in complex texts. Respondents may have to integrate multiple types of mathematical information where considerable translation or interpretation is required; draw inferences; develop or work with mathematical arguments or models; and justify, evaluate and critically reflect upon solutions or choices.
Level 4 **(326 – 375)**	Tasks at this level require the respondent to understand a broad range of mathematical information that may be complex, abstract or embedded in unfamiliar contexts. These tasks involve undertaking multiple steps and choosing relevant problem-solving strategies and processes. Tasks tend to require analysis and more complex reasoning about quantities and data; statistics and chance; spatial relationships; and change, proportions and formulas. Tasks at this level may also require understanding arguments or communicating well-reasoned explanations for answers or choices.
Level 3 **(276 – 325)**	Tasks at this level require the respondent to understand mathematical information that may be less explicit, embedded in contexts that are not always familiar and represented in more complex ways. Tasks require several steps and may involve the choice of problem-solving strategies and relevant processes. Tasks tend to require the application of number sense and spatial sense; recognizing and working with mathematical relationships, patterns, and proportions expressed in verbal or numerical form; and interpretation and basic analysis of data and statistics in texts, tables and graphs.
Level 2 **(226 – 275)**	Tasks at this level require the respondent to identify and act on mathematical information and ideas embedded in a range of common contexts where the mathematical content is fairly explicit or visual with relatively few distractors. Tasks tend to require the application of two or more steps or processes involving calculation with whole numbers and common decimals, percents and fractions; simple measurement and spatial representation; estimation; and interpretation of relatively simple data and statistics in texts, tables and graphs.
Level 1 **(176 – 225)**	Tasks at this level require the respondent to carry out basic mathematical processes in common, concrete contexts where the mathematical content is explicit with little text and minimal distractors. Tasks usually require one-step or simple processes involving counting, sorting, performing basic arithmetic operations, understanding simple percents such as 50%, and locating and identifying elements of simple or common graphical or spatial representations.
Below Level 1 **(0 – 175)**	Tasks at this level require the respondents to carry out simple processes such as counting, sorting, performing basic arithmetic operations with whole numbers or money, or recognizing common spatial representations in concrete, familiar contexts where the mathematical content is explicit with little or no text or distractors.

Exhibit B-4. Examples of numeracy items

Items that exemplify the pertinent features of the proficiency levels in the domain of numeracy are described below. In order to be consistent with the OECD international report, Levels 4 and 5 are combined in the figures in this report (Level 4/5). No items mapped at Level 5 in numeracy.

Level 4: Education level (Item ID: C632P001)
Difficulty score: 354

The stimulus for this item consists of two stacked-column bar graphs presenting the distribution of the Mexican population by years of schooling for men and women separately. The y-axis of each of the graphs is labeled "percentage" with 6 grid lines labeled "0%", "20%", "40%", "60%", "80%", and "100%". The x-axis is labeled "year" and data are presented for 1960, 1970, 1990, 2000, and 2005. A legend identifies three categories of schooling: "more than 6 years of schooling", "up to 6 years of schooling", and "no schooling". The test-taker is asked to approximate what percentage of men in Mexico had more than 6 years of schooling in 1970, choosing from a pull-down menu that has 10 response categories: "0-10%", "10-20%", and so on.

Level 3: Package (Item ID: C657P001)
Difficulty score: 315

The stimulus for this item consists of an illustration of a box constructed from folded cardboard. The dimensions of the cardboard base are identified. The test-taker is asked to identify which plan best represents the assembled box out of four plans presented in the stimulus.

Level 2: Logbook (Item ID: C613A520)
Difficulty score: 250

The stimulus for this item consists of a page from a motor vehicle logbook with columns for the date of the trip (start and finish), the purpose of the trip, the odometer reading (start and finish), the distance travelled, the date of entry and the driver's name and signature. For the first date of travel (June 5), the column for the distance travelled is completed. The instructions inform the test-taker that "a salesman drives his own car and must keep a record of the miles he travels in a Motor Vehicle Log. When he travels, his employer pays him $0.35 per mile plus $40.00 per day for various costs such as meals." The test-taker is asked to calculate how much he will be paid for the trip on June 5.

Level 1: Candles (Item ID: C615A602)
Difficulty score: 221

The stimulus for this item consists of a photo of a box containing tea light candles. The packaging identifies the product (tea light candles), the number of candles in the box (105 candles) and its weight. While the packaging partially covers the top layer of candles, it can be seen that the candles are packed in five rows of seven candles each. The instructions inform the test-taker that there are 105 candles in a box and asks him or her to calculate how many layers of tea light candles are packed in the box.

Below Level 1: Price tag (Item ID: C602A501)
Difficulty score: 168

The stimulus for this item consists of four supermarket price tags. These identify the product, the price per pound, the net weight, the date packed and the total price. The test-taker is asked to indicate the item that was packed first by simply comparing the dates on the price tags.

Problem solving in technology-rich environments

PIAAC represents the first attempt to assess problem solving in technology-rich environments on a large scale and as a single dimension in an international context. PIAAC defines problem solving in technology-rich environments as *"using digital technology, communication tools, and networks to acquire and evaluate information, communicate with others, and perform practical tasks"* (OECD 2012).

Digital technology has revolutionized access to information and communication capabilities over the past two decades. In particular, the Internet has increased instantaneous access to large amounts of information and has expanded instant voice, text, and graphics capabilities across the globe. In order to effectively operate in these environments, it is necessary to have

- knowledge of how various technological environments are structured (e.g., an understanding of the basics of the environment, including how to use command names, drop-down menus, naming protocols for files and folders, and links in a web page); and
- the ability to interact effectively with digital information; understand electronic texts, images, graphics, and numerical data; and locate, evaluate, and critically judge the validity, accuracy, and appropriateness of the accessed information.

These skills constitute the core aspects of the problem solving in technology-rich environments domain.

Items in this domain present tasks of varying difficulty in simulated software applications using commands and functions commonly found in e-mail, web pages, and spreadsheets. These tasks range from purchasing particular goods or services online and finding interactive health information to managing personal information and business finances.

PIAAC recognizes the diversity of digital technologies and the fact that they are evolving at a rapid pace, but due to implementation constraints, the first round of PIAAC was limited to using computers and simulated computer networks. The tasks assessing problem solving in technology-rich environments were only administered via computer and therefore only those taking the computerized assessment received a score in this domain.

Exhibit B-5. Description of PIAAC proficiency levels on the problem solving in technology-rich environments scale

Proficiency levels and cut scores for problem solving in technology-rich environments	Problem solving in technology-rich environments task descriptions
Level 3 **(341 – 500)**	At this level, tasks typically require the use of both generic and more specific technology applications. Some navigation across pages and applications is required to solve the problem. The use of tools (e.g., a sort function) is required to make progress towards the solution. The task may involve multiple steps and operators. The goal of the problem may have to be defined by the respondent, and the criteria to be met may or may not be explicit. There are typically high monitoring demands. Unexpected outcomes and impasses are likely to occur. The task may require evaluating the relevance and reliability of information in order to discard distractors. Integration and inferential reasoning may be needed to a large extent.
Level 2 **(291 – 340)**	At this level, tasks typically require the use of both generic and more specific technology applications. For instance, the respondent may have to make use of a novel online form. Some navigation across pages and applications is required to solve the problem. The use of tools (e.g., a sort function) can facilitate the resolution of the problem. The task may involve multiple steps and operators. The goal of the problem may have to be defined by the respondent, though the criteria to be met are explicit. There are higher monitoring demands. Some unexpected outcomes or impasses may appear. The task may require evaluating the relevance of a set of items to discard distractors. Some integration and inferential reasoning may be needed.
Level 1 **(241 – 290)**	At this level, tasks typically require the use of widely available and familiar technology applications, such as e-mail software or a web browser. There is little or no navigation required to access the information or commands required to solve the problem. The problem may be solved regardless of the respondent's awareness and use of specific tools and functions (e.g., a sort function). The tasks involve few steps and a minimal number of operators. At the cognitive level, the respondent can readily infer the goal from the task statement; problem resolution requires the respondent to apply explicit criteria; and there are few monitoring demands (e.g., the respondent does not have to check whether he or she has used the appropriate procedure or made progress towards the solution). Identifying content and operators can be done through simple match. Only simple forms of reasoning, such as assigning items to categories, are required; there is no need to contrast or integrate information.
Below Level 1 **(0 – 240)**	Tasks are based on well-defined problems involving the use of only one function within a generic interface to meet one explicit criterion without any categorical or inferential reasoning, or transforming of information. Few steps are required and no sub-goal has to be generated.

Exhibit B-6. Examples of problem solving in technology-rich environments items

Items that exemplify the pertinent features of the proficiency levels in the domain of problem solving in technology-rich environments are described below.

Level 3: Meeting rooms (Item ID: U02)
Difficulty score: 346

This task involves managing requests to reserve a meeting room on a particular date using a reservation system. Upon discovering that one of the reservation requests cannot be accommodated, the test-taker has to send an e-mail message declining the request. Successfully completing the task involves taking into account multiple constraints (e.g., the number of rooms available and existing reservations). Impasses exist, as the initial constraints generate a conflict (one of the demands for a room reservation cannot be satisfied). The impasse has to be resolved by initiating a new sub-goal, i.e., issuing a standard message to decline one of the requests. Two applications are present in the environment: an e-mail interface with a number of e-mails stored in an inbox containing the room reservation requests, and a web-based reservation tool that allows the user to assign rooms to meetings at certain times. The item requires the test-taker to "[u]se information from a novel web application and several e-mail messages, establish and apply criteria to solve a scheduling problem where an impasse must be resolved, and communicate the outcome." The task involves multiple applications, a large number of steps, a built-in impasse, and the discovery and use of ad hoc commands in a novel environment. The test-taker has to establish a plan and monitor its implementation in order to minimize the number of conflicts. In addition, the test-taker has to transfer information from one application (e-mail) to another (the room-reservation tool).

Level 2: Club membership (Item ID: U19b)
Difficulty score: 296

This task involves responding to a request for information by locating information in a spreadsheet and e-mailing the requested information to the person who asked for it. The test-taker is presented with a word-processor page containing a request to identify members of a bike club who meet two conditions, and a spreadsheet containing 200 entries in which the relevant information can be found. The required information has to be extracted by using a sort function. The item requires the test-taker to "[o]rganize large amounts of information in a multiple-column spreadsheet using multiple explicit criteria and locate and mark relevant entries." The task requires switching between two different applications and involves multiple steps and operators. It also requires some amount of monitoring. Making use of the available tools greatly facilitates identifying the relevant entries.

Level 1: Party invitations (Item ID: U01A)
Difficulty score: 286

This task involves sorting e-mails into pre-existing folders. An e-mail interface is presented with five e-mails in an inbox. These e-mails are responses to a party invitation. The test-taker is asked to place the response e-mails into a pre-existing folder to keep track of who can and cannot attend a party. The item requires the test-taker to "[c]ategorize a small number of messages in an e-mail application in existing folders according to a single criterion." The task is performed in a single and familiar environment and the goal is explicitly stated in operational terms. Solving the problem requires a relatively small number of steps and the use of a restricted range of operators and does not demand a significant amount of monitoring across a large number of actions.

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Appendix C: Methodology and Technical Notes

This appendix describes the assessment design, sampling, data collection, weighting and variance estimation, scaling, and statistical testing procedures used to collect and analyze the data for this supplemental PIAAC report. The Main Study household data collection was conducted from August 25, 2011 through April 3, 2012, and the National Supplement household data collection occurred from August 26, 2013 through May 5, 2014.

Assessment Design

The PIAAC psychometric assessment design was complex because the assessment measured four domains—literacy, numeracy, reading components, and problem solving in technology-rich environments—across two modes of administration—paper-and-pencil and computer instruments. In summary, the PIAAC psychometric assessment design for the household sample provided for the following information:

- reading component skills among lower performing adults in each participating country, as well as among those who reported not knowing how to use a computer;
- population distributions in literacy, which could be linked to the International Adult Literacy Survey (IALS) and Adult Literacy and Lifeskills Survey (ALL);
- population distributions in numeracy, which could be linked to ALL;
- accurate estimates of population distributions and a baseline measure of problem solving in technology-rich environments for future estimation of trends over time;
- insights into strategies and processes that adults used when they responded to the tasks on problem solving in technology-rich environments;
- pairwise covariance estimates among the various measures, including the relationships between literacy and numeracy, literacy and reading components skills, literacy and problem solving in technology-rich environments, numeracy and reading components skills, and numeracy and problem solving in technology-rich environments; and
- information that could be used to analyze the relationship between the measured competencies and the PIAAC behavioral measures and social/economic measures (from the responses to the background questions and job requirements approach module).

PIAAC was designed as a computer-based assessment. Respondents who had little or no familiarity with computers, however, were directed to a paper-and-pencil version of the assessment that tested skills in the domains of literacy and numeracy only. Approximately 15 percent of the respondents in the Main Study and 23 percent in the National Supplement were directed to the paper-and-pencil path. Regardless of whether they took the assessment in the computer or paper-and-pencil format, all respondents first took a "Core" test to assess their capacity to undertake the full assessment. Those who were unsuccessful at the Core test were directed to the assessment of reading components. Those who succeeded at the Core test proceeded to the full assessment.

The PIAAC assessment included an adaptive element that allowed for automatic scoring. Based on their performance at different points in the assessment, respondents taking the computer-based version were directed to different "testlets" that contained items of different average difficulty in the domains of literacy and numeracy.

Sampling

For the 2012 PIAAC Main Study household sample, the target population consisted of non-institutionalized adults between the ages of 16 and 65 (inclusive). The assessment included a nationally representative probability sample of 9,468 housing units that resulted in 5,010 individual respondents. This household sample was selected on the basis of a four-stage, stratified area sample: (1) primary sampling units (PSUs) consisting of counties or groups of contiguous counties; (2) secondary sampling units (referred to as segments) consisting of area blocks; (3) housing units containing households; and (4) eligible persons within households.

The purpose of the 2014 U.S. PIAAC National Supplement household sample was to provide additional samples of adults for the unemployed (age 16 to 65), two groups of young adults (age 16 to 24 and 25 to 34), and a group of older adults (age 66 to 74). Given the low prevalence of unemployed adults in the population, a dual frame approach was implemented as an efficient method of sampling rare populations. The dual frame approach consisted of an area sample and a list sample. An area sample of 9,579 housing units was selected from the same PSUs and segments selected for the Main Study, after removing the housing units previously released. One or more persons from the National Supplement household sample target population was/were selected within a household. To obtain additional unemployed adults, five high unemployment Census tracts were identified within each of the sampled PSUs and one was randomly selected for the list sample. The United States Postal Service address list was purchased for each of the sampled tracts, and a sample of 6,956 households was taken from these lists. Within the sampled households, only those who were unemployed were eligible for selection. There were 3,660 individuals that responded in the 2014 U.S. PIAAC National Supplement household sample which included the three subgroups of interest (unemployed adults, young adults, and older adults).

For both the Main Study and the National Supplement household sample, person-level data were collected through a screener, a background questionnaire, and the assessment. The screener instrument was conducted using a computer-assisted personal interviewing system and collected information that included age and gender of all household members. It determined which household member or members was/were eligible for the study and selected the sample person(s). Of the 26,003 sampled housing units in the combined Main Study and National Supplement household sample, 3,500 were either vacant or not a housing unit, resulting in a sample of 22,503 households. A total of 9,460 households had at least one eligible adult and completed the screener (more than one adult per household could be selected to complete the questionnaire), which was used to select survey respondents. The final screener response rate was 84.7 percent weighted (note that all response rates referenced in this section were computed using base weights for the combined sample).

Based on the screener data, 10,668 respondents age 16 to 74 were selected to complete the background questionnaire and the assessment; 8,488 actually completed the background questionnaire. Of the 2,180 respondents who did not complete the background questionnaire, 182 were unable to do so because of a literacy-related barrier: either the inability to communicate in English or Spanish (the two languages in which the background questionnaire was administered), a reading or writing difficulty, or a mental disability. The final response rate for the background questionnaire—which included respondents who completed it and respondents who were unable to complete it because of a literacy-related barrier—was 80.9 percent weighted.

Of the 8,488 adults age 16 to 74 who completed the background questionnaire, 8,341 completed the adult literacy assessment. An additional 26 were unable to complete the assessment for literacy-related reasons. The final response rate for the overall assessment—which included respondents who answered at least one question on each scale and the 26 respondents who were unable to do so because of a language problem or mental disability—was 98.8 percent weighted.

As described by PIAAC Technical Standard 4.3.3, a completed case contained at least the following:

- responses to key background questions, including age, gender, highest level of schooling, and employment status; and
- a completed Core instrument[1] (i.e., the interviewer asked the respondent all Core questions or the Core instrument was not completed for a literacy-related reason [e.g., because of a language difficulty] or because the respondent was unable to read or write in any of a country's PIAAC official languages); or
- responses to age and gender for literacy-related nonrespondents to the background questionnaire/ Job Requirements Approach.

The overall weighted response rate for the household sample was 67.8 percent.

Table C-1. Weighted response rate for the United States, by survey component and sample: 2012 and 2014

| Component | Main Study (percent) | National Supplement | | Main Study and National Supplement Combined (percent) |
		Area Sample (percent)	List Sample (percent)	
Screener (household)	86.5	81.4	84.8	84.7
Background questionnaire	82.2	78.1	92.9	80.9
Assessment (without reading component)	99.0	98.5	98.8	98.8
Overall rate (product of component response rates)	70.3	62.6	77.9	67.8

For respondents who did not complete any tasks on any of the literacy scales, no information is available about their performance on the literacy items. Completely omitting these individuals from the analyses would have resulted in unknown biases in estimates of the literacy skills of the national population because refusals cannot be assumed to have occurred randomly. For respondents who answered the background questionnaire but refused to complete the assessment for reasons other than language issues or a mental disability, proficiency values were imputed based on the covariance information from those who completed the survey.

The final household reporting sample (combined U.S. 2012 and 2014 sample)—including the literacy-related nonrespondents to the background questionnaire—consisted of 8,670 respondents. These 8,670 respondents are the 8,490 respondents who completed the background questionnaire, plus the 180 respondents who were unable to complete the background questionnaire for literacy-related reasons. Of the 8,490 respondents who completed the background questionnaire, 7,760 were age 16 to 65 and 730 were age 66 to 74. Of the 7,760 respondents who were age 16 to 65, there were 1,450 who were unemployed.

The sample was subject to unit nonresponse from the screener, background questionnaire, assessment (including reading components), and item nonresponse to background questionnaire items. The screener and background questionnaire stages had unit response rates below 85 percent and thus required an analysis of the potential for nonresponse bias according to NCES statistical standards.

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[1] For a full description of the Core instrument, see the section on Data Collection.

Nonresponse Bias

The nonresponse bias analysis of the household sample revealed differences in the characteristics of respondents who participated in the background questionnaire compared with those who refused. In a bivariate unit-level analysis at the background questionnaire stage, estimated percentages for respondents were compared with those for the total eligible sample to identify any potential bias owing to nonresponse. Multivariate analyses were conducted to further explore the potential for nonresponse bias by identifying the domains with the most differential response rates. The three samples (Main Study, National Supplement area sample, and National Supplement list sample) were analyzed separately to inform the separate nonresponse weighting adjustments for each sample.

For the Main Study, these analyses revealed that the subgroup with the lowest response rates for the background questionnaire had the following characteristics: (1) Hispanic, (2) age 26 and older with no children in the household, and (3) reside outside the Northeastern United States in areas with low levels of linguistic isolation (a low percentage who have some difficulty speaking English) and with unemployment rates exceeding approximately 5 percent. For the National Supplement area sample, the lowest response rates to the background questionnaire were for persons with the following characteristics: (1) age 25 to 34 or older than 55, (2) sampled as not unemployed (age 16 to 34) or older (age 66 to 74), (3) no children in the household, (4) reside in the Northeastern United States in a census tract with an employment rate exceeding approximately 65 percent and in which more than approximately 2 percent of the population is foreign born. For the National Supplement list sample, the subgroup with the lowest background questionnaire response rate corresponded to the following: (1) female with no children in the household, (2) reside in a Metropolitan Statistical Area in the Western or Northeastern United States, and (3) reside in a census tract in which less than approximately 29 percent of the population has a high school education.

In general, persons with children in the household were found to be more likely to participate, as were persons in areas with a high percentage of the population below 150 percent of poverty. However, the variables found to be significant in the multivariate analysis—those used to define areas with low response rates—were used in weighting adjustments in an effort to reduce bias.

Data Collection

Whenever possible, interviewers administered the background questionnaire and assessment in a private setting (e.g., home or library). Using the computerized interview and assessment software provided by the PIAAC Consortium,[2] the interviewer read the background questionnaire questions from a laptop and entered all responses directly into the laptop. Skip patterns and follow-up probes for contradictory or out-of-range responses were programmed into the interview software. At the completion of the background questionnaire, the participant was administered the computer-based Core or the paper-and-pencil based Core if the participant could not or would not use the computer. Upon the completion and scoring of the Core tasks, the respondent was routed to the computer-based assessment (CBA), the paper-based assessment (PBA) of literacy and numeracy, or the paper-based reading components. The background questionnaire and the assessment took approximately two hours to complete; however, the time varied by the respondent. The number of assessment items also varied based on the respondents' performance on the Core and the adaptive routing implemented in the automated portion of the assessment.

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[2] The PIAAC Consortium includes the following organizations: Educational Testing Service (ETS), Westat, cApStAn, the Research Centre for Education and the Labor Market (ROA), gesis-ZUMA Centre for Survey Research, German Institute for International Education Research (DIPF), and the Data Processing Centre of the International Association for the Evaluation of Educational Achievement (IEA). In addition to these organizations, PIAAC is aided by numerous national contracting partners.

Progress through the assessment was controlled by the computer based on the respondent's performance on various components of the assessment. The PIAAC assessment was composed of the following components:

- The Core consisted of three modules: the CBA Core Stage 1, the CBA Core Stage 2, and the PBA Core.
    - The CBA Core Stage 1 included six tasks and was designed to determine if the participant had the basic set of information and communication technology (ICT) skills needed to complete the computer-based assessment. To pass the CBA Core Stage 1, the participant needed to correctly answer at least three of the first five tasks, plus the sixth task (highlighting text). CBA Core Stage 1 questions were automatically scored by the computer, and a participant who passed the CBA Core Stage 1 continued on to the CBA Core Stage 2. A participant who did not pass the CBA Core Stage 1 was routed to the PBA Core.
    - The CBA Core Stage 2 included six tasks that measured basic literacy and numeracy skills necessary to undertake the assessment. CBA Core Stage 2 questions were automatically scored by the computer, and a participant who passed the CBA Core Stage 2 continued on to the computer-based assessment. A participant who did not pass the CBA Core Stage 2 was routed directly to the paper-based reading components section.
    - The PBA Core consisted of eight tasks and measured basic literacy and numeracy skills necessary to undertake the assessment. PBA Core questions were interviewer scored and entered into the computer to determine if the participant passed the PBA Core. A participant who passed the PBA Core continued on to the paper-based assessment of literacy and numeracy and then to the paper-based reading components section. A participant who did not pass the PBA Core was routed directly to the reading components section.
- The assessment was administered in CBA and PBA modes.
    - The CBA consisted of three "testlets" of tasks at Stage 1 (9 items) and four "testlets" at Stage 2 (11 items). Each respondent completed two testlets that included items from two of the three domains.
    - The PBA consisted of two paper-based assessment booklets, one contained literacy items and one contained numeracy items. Each booklet contained 20 items for the participant to complete and each participant completed only one booklet type.
- The reading components were completed by a participant after completing the literacy or numeracy booklet. Reading components were also completed by a respondent who failed the CBA Core Stage 2 or the PBA Core.

Problem Solving in Technology-Rich Environments: U.S. Sample

The PIAAC assessment design was developed to route respondents to the most appropriate delivery mode as a means to help assure the most reliable, valid, and comparable assessment of skills. The computer-based assessment (CBA) was chosen for those demonstrating information and communication technology (ICT) skills, while the remaining respondents received the paper-based assessment (PBA). The scores for respondents who had no computer experience, failed the ICT skills test, or refused the CBA did not contribute to the estimation of the item parameters for the problem solving in technology-rich environments (PS-TRE) domain. The design of the PIAAC assessment contained only literacy and numeracy in the PBA because the problem solving in technology-rich environments assessment, by definition, was suitable only for respondents familiar with ICT environments. Exhibit C-1 illustrates the different stages of the assessment administration and the different pathways that respondents could follow based on their responses to questions on ICT use in the background questionnaire (BQ). For each pathway, the weighted percentages of U.S. respondents who followed that pathway are shown. For example, the percentage of U.S. respondents who said they had some computer experience and were thus routed to the CBA was 89.2 percent, but the percentage of all U.S. respondents who were routed to the CBA and eventually received the literacy and numeracy assessment was 19.2 percent while the percentage who received literacy and PS-TRE was 6.8 percent.

Exhibit C-1. PIAAC Main Study and National Supplement yield: 2012 and 2014
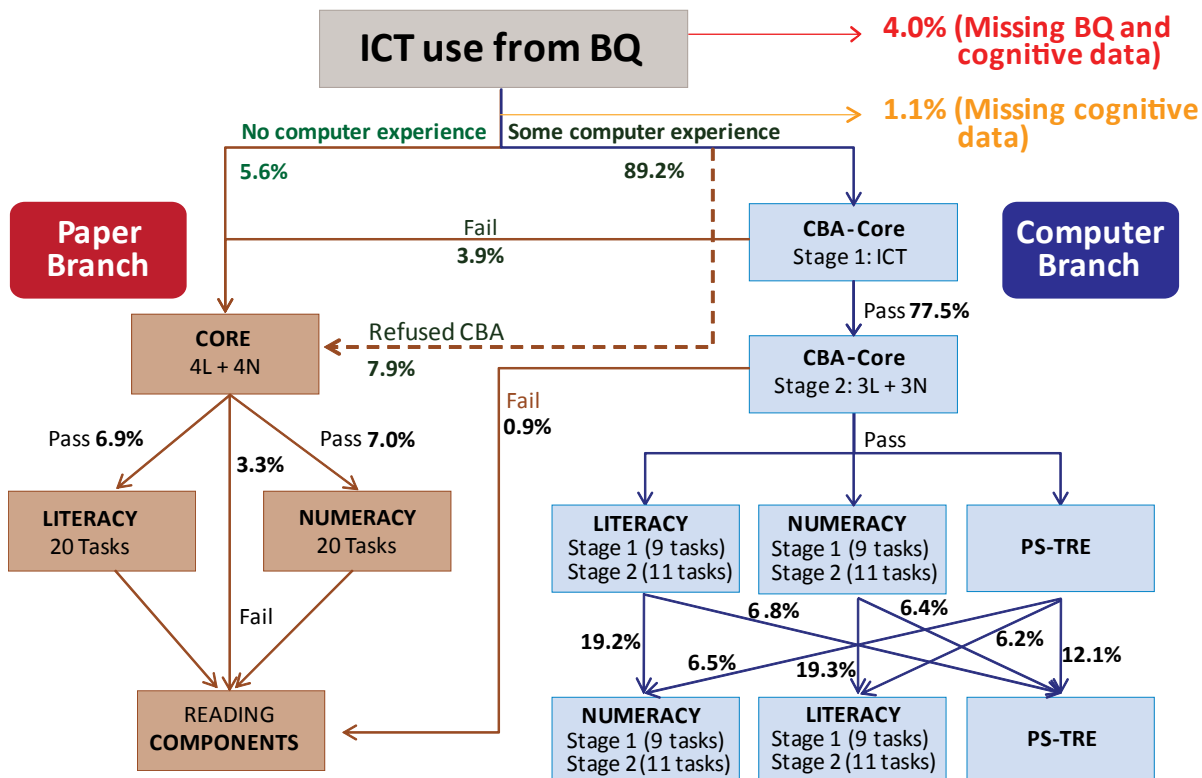
Weighting and Variance Estimation

A dual-frame, complex sample design was used to select assessment respondents. The properties of a sample selected through a complex design could be very different from those of a simple random sample in which every individual in the target population has an equal chance of selection and in which the observations from different sampled individuals can be considered statistically independent of one another. Therefore, the properties of the sample for the complex data collection design were taken into account during the analysis of the data.

One way of addressing the properties of the sample design was by using *sampling weights* to composite the Main Study and National Supplement household samples and account for the fact that the prob-

abilities of selection were not identical for all respondents. For the household sample, the sampling weights were further adjusted for nonresponse to the screener and background questionnaire, extreme weights were trimmed, and weights for all respondents were calibrated to the U.S. Census Bureau's 2012 American Community Survey population totals for those age 16 to 74. Since literacy-related nonrespondents to the screener, the background questionnaire, and the assessment are similar in proficiency, the weights of the literacy-related nonresponse cases were not adjusted during the screener-level nonresponse adjustment. Instead, the background questionnaire weights for the background questionnaire and assessment literacy-related cases were adjusted to account for the literacy-related screener nonrespondents. This adjustment was necessary primarily to allow the literacy-related background questionnaire and assessment nonrespondents to represent the literacy-related screener nonrespondents in the calibration procedure.

All population and subpopulation characteristics based on the PIAAC data used sampling weights in their estimation. The statistics presented in this report are estimates of group and subgroup performance based on a sample of respondents, rather than the values that could be calculated if every person in the nation answered every question on the instrument. Therefore, it is important to have measures of the degree of uncertainty of the estimates. Accordingly, in addition to providing estimates of percentages of respondents and their average scale scores, this report provides information about the uncertainty of each statistic in the form of standard errors on the U.S. PIAAC website at http://nces.ed.gov/surveys/piaac/results/summary.aspx.

Because the assessment used clustered sampling, conventional formulas for estimating sampling variability (e.g., standard errors) that assume simple random sampling and hence independence of observations would have been inappropriate for this report. For this reason, the PIAAC assessment used a paired jackknife replication approach (sometimes referred to as JK2) to estimate standard errors (Rust and Rao 1996).

Changes in Population Totals from 2012 Main Study

For the 2012 data collection, weights for all respondents were calibrated to the U.S. Census Bureau's 2010 American Community Survey population totals for those age 16 to 65. The 2010 American Community Survey population totals were derived from 2000 U.S. Census projections because the full 2010 U.S. Census population results were not yet available. Once the 2010 U.S. Census population results were finalized, the U.S. Census refreshed its entire time series of estimates going back to the previous census each year using the most current data and methodology. One result of this refresh is a shift in the proportion of the population with more education. A comparison of the population totals used to calibrate the 2012 Main Study data with those used to calibrate the composite 2012 and 2014 data reveals that the percentage of the U.S. population age 16 to 65 with college experience (some college or a college degree) increased by 3 to 4 percent and the percentage of the population age 16 to 65 with less than a high school diploma decreased 4 percent. This change has no effect on PIAAC's measurement of skills in the United States, but it does mean that the proportions of the population with higher skills have been found to be larger than previously estimated for the 2012 Main Study.

Scaling

Information on scaling in the PIAAC assessment can be found on the OECD PIAAC website at http://www.oecd.org/site/piaac/.

Statistical Testing

The statistical comparisons in this report were based on the *t* statistic. Statistical significance was determined by calculating a *t* value for the difference between a pair of means or proportions, and comparing this value with published tables of values at a certain level of significance, called the alpha level. The alpha level is an *a priori* statement of the probability of inferring that a difference exists when, in fact, it does not. Findings from *t*-tests are reported based on a statistical significance (or alpha level) set at .05, without adjustments for multiple comparisons.