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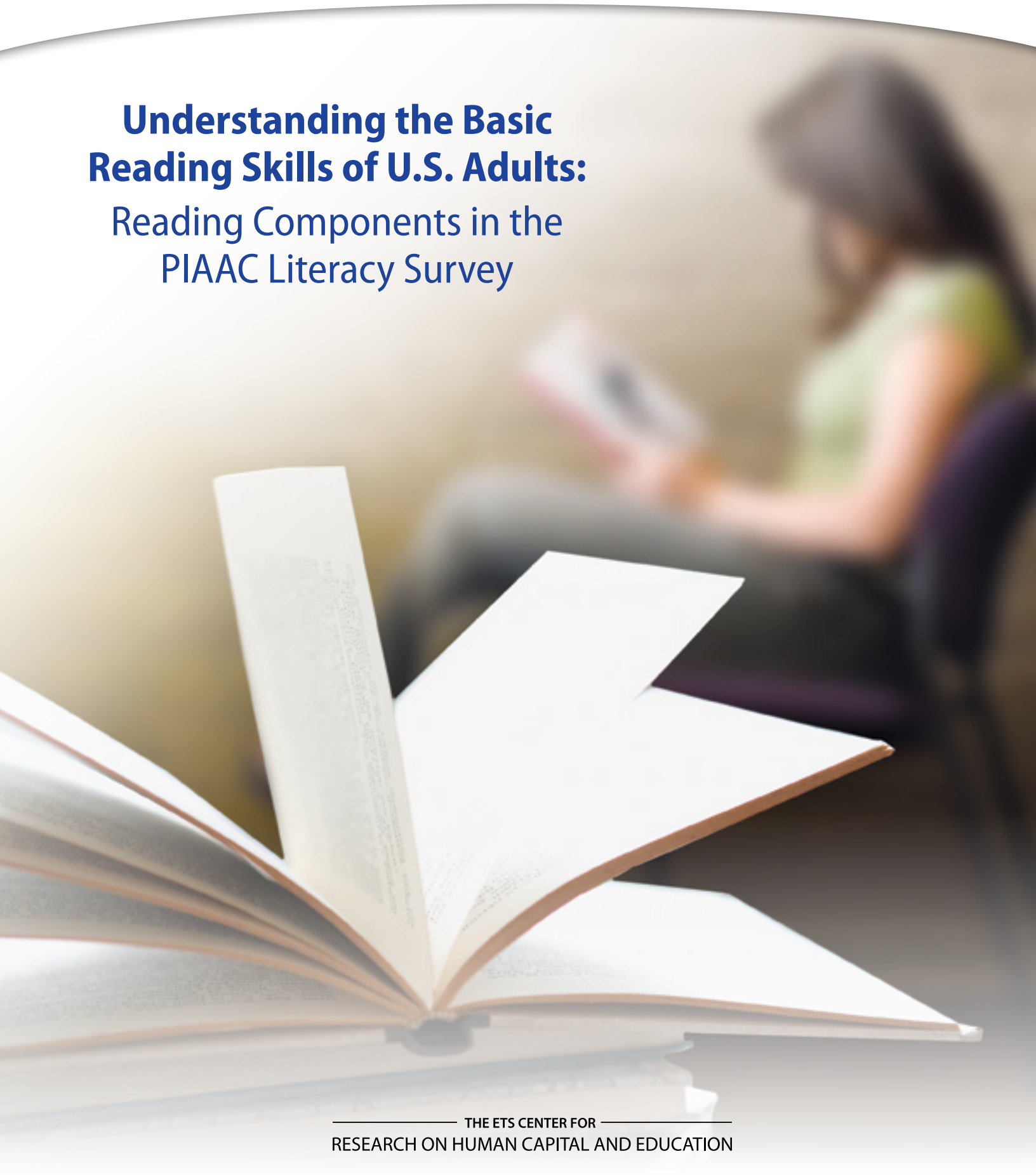
Understanding the Basic Reading Skills of U.S. Adults:

Reading Components in the PIAAC Literacy Survey



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John Sabatini • Educational Testing Service • Princeton, N.J. • December 2015

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INTRODUCTION

The results of the Programme for the International Assessment of Adult Competencies (PIAAC) survey paint a troubling portrait of the literacy skills of adults in the United States.[1] The survey included a direct assessment of skills and was conducted in 23 countries with nationally representative samples of adults ages 16 through 65. Assessed were cognitive and workplace skills needed for success in the 21st-century global economy. In a report entitled *Time for the U.S. to Reskill? What the Survey of Adult Skills Says*,[2] prepared by the OECD at the request of the U.S. Department of Education, it was found that the skills of adults in the United States have remained relatively unchanged in the decade since the previous report,[3] while other countries have been showing improvements, especially among adults with low basic skills.

The ability to read fluently and for understanding—to be able to learn from text—is perhaps the most important foundational skill for U.S. adult citizens' health, well-being, and social and economic advancement. It is a gateway to lifelong learning, education, and training. With the emergence of the Internet and social networking (which operate primarily through the written word), reading literacy provides control over an immeasurable, readily accessible library of the world's knowledge, as well as the ability to communicate with friends, family, and employers. While the digital revolution has increased the prevalence of and, access to, visual/aural media, written text—whether on paper or screen—continues to be an omnipresent currency of communication and commerce, except for adults who continue to struggle to read.[4]

Adults who have trouble reading, using mathematics, solving problems, and using technology are at a disadvantage when competing for jobs in the 21st-century workforce.[5] The situation is perhaps most dire for those at the lowest level of reading literacy skills, because limited literacy skill reduces their access to print-based training and educational opportunities that could be used to enhance their social and workforce skills. Low literacy adults are not necessarily isolated, thanks to the ever-present visual media and communications available. However, their potential is limited because they cannot use printed media to learn, grow their knowledge, and seek opportunities. Interpersonally, it is often painfully obvious to adults when they cannot read well, as it also is to the casual observer. When confronted with text and a task, they can be observed puzzling and lingering for longer than proficient readers do when performing the same literacy activity.

International surveys have consistently documented percentages of adults who score at or below Level 1 on the reading literacy proficiency scale,[6] with international

averages at 3.3% and 12.2% for Below Level 1 and Level 1, respectively, in the most recent survey.[7] Before the PIAAC 2011 survey, however, essentially all that one could infer about the literacy skills of adults below Level 1 was that they could not consistently perform accurately on the easiest literacy tasks on the survey. One could not estimate what literacy tasks they could do successfully, if any.

One primary reason for introducing a battery of reading component tasks to the PIAAC literacy assessment was the desire to have richer information from which to draw implications for policy, as well as for learning and instruction, for adults who score at or below Level 1 in literacy proficiency. What do we know about the reading literacy profiles of adults with low literacy scores in the United States in comparison to other countries? What are the underlying reading skills of adults below Level 1 proficiency? Do they truly have no literacy skills at all? For adults at Level 1, is there evidence of mastery of foundational component skills?

Policy makers and educators can benefit from understanding what kinds of skills that adults bring to learning programs, because the learning needs of those with very low skill levels may differ from those with more intermediate levels of skills,[8] as perhaps best explained in the seminal work of Jean Chall.[9] Chall distinguished learning to read—that is, the mastery of decoding, word recognition, and reading fluency—from reading to learn or to do—that is, using text to build one's knowledge or accomplish specific goals. Adults at or below Level 1 have needs at both levels.[10] To build fluent, efficient foundational reading skills may require direct knowledge and skill instruction, as well as practice with applying skills to build up fluency of application in literacy contexts at home or in the workplace.[11]

The most elementary applied literacy tasks of the general, cognitive survey (for example, locating a single piece of information in a paragraph of text), while easy relative to the other tasks, are not the most basic, foundational tasks that indicate reading literacy skill. Also, they are not aligned with evidence-based instructional approaches typically used when teaching beginning readers.[12] Component reading literacy tasks, on the other hand, assess the foundational skills that enable prose literacy comprehension. Such tasks can probe knowledge of the alphabet, decoding, word recognition, word meaning knowledge, sentence comprehension, and basic passage reading.

The introduction of reading component tasks in the 2011 PIAAC survey provided a rich opportunity to better understand adults with low literacy proficiency scores in the United States in comparison to similar populations in other countries. Reading components results help us to understand what adults with scores at or below Level 1 can and cannot do. Can they identify the meaning of high-frequency vocabulary words

when they appear in print? Can they evaluate the meaning of single sentences? Can they read for local meaning in simple passages? That is, what is the range and variation in foundational skills among the lowest scoring adults in a country? These are the questions addressed in this report.

In sum, the reading components tasks in PIAAC were designed to complement the applied literacy tasks in order to provide a richer sense of what adults scoring at or below Level 1 can and cannot do when engaging and processing basic written words, sentences, and passages. In the remainder of the report, we describe in more detail a) the reading component measures, including the theoretical and empirical rationale for adopting this framework; b) the results in a select set of countries that participated in the PIAAC survey; and c) implications of those findings for policy and practice.

THEORETICAL BACKGROUND: UNDERSTANDING THE READING PROCESSES OF ADULTS USING READING COMPONENT SKILLS TASKS

The PIAAC survey assessed the proficiency of adults in three information-processing skills: literacy, numeracy, and problem solving in technology-rich environments. For PIAAC, literacy is defined as "understanding, evaluating, using and engaging with written texts to participate in society, to achieve one's goals, and to develop one's knowledge and potential."[13] In the main literacy assessment, texts could be digital (such as Web pages or emails) or print-based (such as newspapers, books, or pamphlets). Regardless of the format, texts could be continuous (such as passages), noncontinuous (such as tables or forms), mixed, or multiple (such as a blog post that contains an initial text and related responses or comments). These texts may naturally appear in work-related, personal, social, community, or educational and training contexts. Survey respondents were required to complete tasks that require application of cognitive strategies such as accessing, identifying, integrating, interpreting, evaluating, or reflecting on information in texts.[14]

Reading components, introduced for the first time in the 2011 PIAAC survey, are part of the literacy assessment framework, but targeted toward adults near the bottom of the proficiency distribution.[15] A detailed account of the PIAAC components assessment framework can be found in Sabatini and Bruce,[16] as well as in the reading literacy framework.[17] The rationale for component skills rests on the premise that the "meaning construction" processes of reading are built upon a foundation of knowledge of how one's language is represented in one's writing system, that is, component print skills.[18] Empirical studies in the reading literature over the past several decades have yielded a rich literature for understanding component reading processes in adults.[19] Evidence of an individual's level of print skill can be captured in tasks that can be used to provide evidence of a reader's ability and efficiency in processing the elements of the written language—letters/characters, words, sentences, and larger, continuous text segments.

Reading components are derived from a view of reading literacy skill as a dimension of language proficiency.[20] Language learning is typically thought of in four dimensions —reading, writing, speaking, and listening. For native speakers of languages, foundational speaking and listening skills are acquired developmentally. Children acquire a productive/receptive vocabulary of words that we can refer to as their listening/speaking lexicon. Syntax or grammar is also acquired implicitly, allowing individuals to interpret or produce meaningful phrases, sentences, and longer

discourse in their native language. As native speakers, we can understand what other speakers are saying in "real time," that is, we process meaning at the speed that the speaker is speaking, which is generally in the range of 150 to 175 words per minute for the average adult English speaker.[21]

The challenge, in part, in becoming a fluent, skilled reader, is processing printed text as language written down. That is, if a reader can recognize the words rapidly, automatically, and with ease, then the meaning of words can be processed seamlessly, using functional areas of the brain devoted to understanding language, that is, morphology, syntax, semantics, pragmatics, discourse analysis, and semiotics.[22] Proficient reading component competencies in any language are characterized by the ease, speed, and minimal attentional resources required when cognitively processing written text, sometimes referred to as automaticity.[23] Skilled readers are not typically aware of the spelling, punctuation, or typography of a text; rather their awareness and cognitive effort is applied toward constructing meaning. Thus, an association between reading rate and proficiency is consistently found in studies of adult readers.[24]

Individuals who struggle with reading, on the other hand, expend considerable cognitive effort and attention in translating print into language, which expends cognitive resources that could better be utilized in constructing, interpreting, and evaluating meaning.[25] They struggle with learning to map the writing system (i.e., the printed visual symbols individually and in combination) to the spoken form of the language (i.e., the phonetics, phonology, and morphology).[26] Their reading behavior is characterized by slow, effortful processing of text. This can impact not only their recognition of individual words, but also building meaning from sentences and paragraphs of text.[27]

The irregular mapping of sight-to-sound patterns (and vice versa) in English spelling presents an additional challenge to learning to read fluently.[28] When the spelling system of a language is highly regular—which means that with a pronunciation guide, the same spelling pattern routinely maps to the same sounds when spoken—then it is referred to as a transparent orthography.[29] German, Finnish, Italian, Spanish, and Swedish are examples of languages with relatively transparent spelling systems. When sight-to-sound (and vice versa) mappings are less consistent, more learning and practice is demanded before fluency is achieved.[30]

The above account of learning to read focused on native speakers who face the challenge of learning to apply their native language knowledge and skills when processing written texts. For nonnative speakers of a language in which they are reading, the challenge is even greater. All four dimensions of language—speaking, listening, reading, and writing—may need to be learned. In the United States,

nonnative speakers of English constitute a sizable and significant proportion of the subpopulation scoring at or below Level 1 in literacy. The PIAAC component tasks cannot be used to distinguish whether the source of challenge for nonnative speakers is their ability to read in English versus more general lack of English language ability; thus, the specific instructional implications may differ. Nonetheless, the components provide an indicator of what nonnative speakers scoring at or below Level 1 can and cannot do when reading in English.

The PIAAC reading components framework covers decoding and word recognition components.[31] However, the variations in how a writing system maps to a language differ widely across languages, ranging from alphabetic systems like English and Spanish, to syllabic like the Korean Hangul system, to logographic like the Japanese Kanji system. This cross-language variability led to the decision not to build component tasks for word recognition or decoding in the main PIAAC survey.

Instead, the PIAAC reading components targeted three other levels of reading literacy that correspond to structural levels of language—word meaning, sentence processing, and basic passage comprehension. The word meaning, or print vocabulary,[32] tasks targeted the mental lexicon of frequent, concrete words. The sentence processing tasks targeted basic syntactic and semantic knowledge and processing. Finally, the basic passage comprehension tasks targeted discourse processes. Each of these task sets and their corresponding interpretation is discussed more fully in the following sections. The PIAAC component tasks were administered in a paper-based booklet format to all individuals who took the paper-based pathway of the survey.

Print Vocabulary

Recognizing the printed symbols on the page as representing meaningful words is foundational to reading literacy.[33] In the print vocabulary task set, the respondent identified everyday words that the average adult speakers of the language would understand if they heard the words spoken aloud. Target words were concrete, imageable nouns of common objects. The items did not include specialized technical or academic words that would only be known by more educated individuals in the population. The words were commonly known across country contexts (e.g., sun, triangle, foot).

Each item in this task set presented an image and four word choices. The respondent had to circle the correct word choice that matched the picture. Figure 1 provides a sample print vocabulary item. Distracters were designed to tap similar semantic and/or orthographic features of the target word. This way, it was less likely that individuals could use only partial knowledge of spelling or visual symbols to guess the

correct answer. For example, in the sample item in Figure 1, a reader might guess based on the first sound of the word "ear" that the spelling starts with "e." However, there are *two* choices that start with "e," making it more challenging to guess.

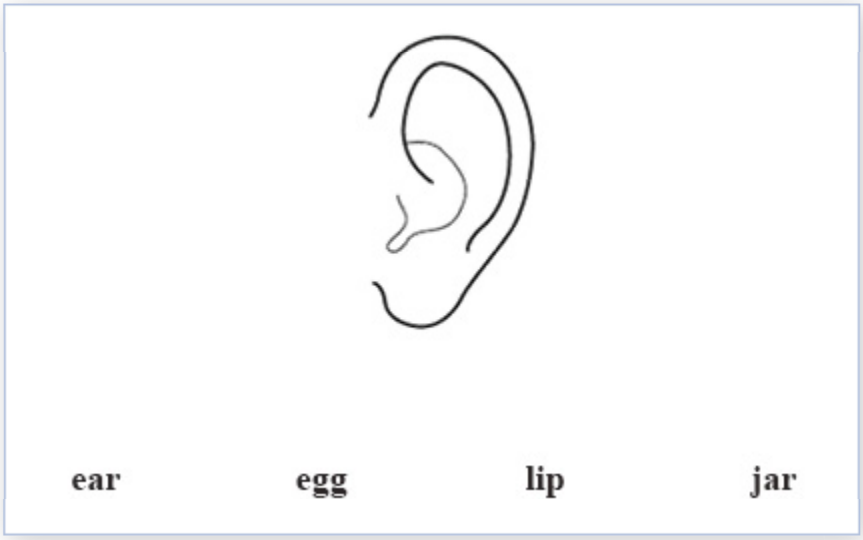

Figure 1. *Sample print vocabulary item.*

Sentence Processing

The sentence is a natural "chunk" when reading continuous text.[34] To build meaning from a sentence includes understanding all the words, parsing the syntactic structure, and encoding the propositions in memory. Depending on the specifics of a sentence, other operations might include making anaphoric (e.g., relating pronouns to their referent), causal, or knowledge-based inferences. Thus, each sentence requires some syntactic and semantic processing.

The sentence processing measure presented sentences of increasing difficulty (as indexed by length and density of information) and asked the respondent to make a sensibility judgment about the sentence with respect to general knowledge about the world or about the internal logic of the sentence. For these items, the respondent read the sentence and circled YES if the sentence made sense or NO if the sentence did not make sense. This task demand is consistent with the "evaluation" goal of reading in the PIAAC reading literacy framework.[35] Even at the most basic reading level, comprehension or understanding may require evaluating text meaning against one's knowledge of the world, to judge its veracity.[36] Figure 2 shows a set of sample sentence processing items.

Three girls ate the song.	YES	NO
The man drove the green car.	YES	NO
The lightest balloon floated in the bright sky.	YES	NO
A comfortable pillow is soft and rocky.	YES	NO
A person who is twenty years old is older than a person who is thirty years old.	YES	NO

Figure 2. *Sample sentence processing items.*

Passage Comprehension

Skilled reading (whether silent or aloud) is rapid, efficient, and fluent. The PIAAC passage comprehension task set targeted silent reading for basic comprehension in multiparagraph prose texts.[37] The integration of decoding, word recognition, vocabulary, and sentence processing was required to construct the basic meaning of a short passage. Fluent, efficient performance on a basic, integrated reading task is a building block for handling longer, more complex literacy texts and tasks.

The passage comprehension measure presented four passages, each with embedded items. Passages were constructed based on the kinds of text types that adults typically encounter: narrative, persuasive, and expository. The design used a forced-choice cloze paradigm—that is, a choice was given between a word that correctly completes a sentence in a passage and an option that was incorrect. As the adults read silently through a passage, they would see a word-choice item in selected sentences. The respondent was asked to read the passage and circle the word among the alternatives that made the sentence make sense (in the context of the passage). The incorrect choice was meant to be obviously wrong to a reader with some basic comprehension skills. The incorrect choice could be grammatically or semantically wrong. A sample passage is shown in Figure 3 with the options for selection underlined within the sentences.

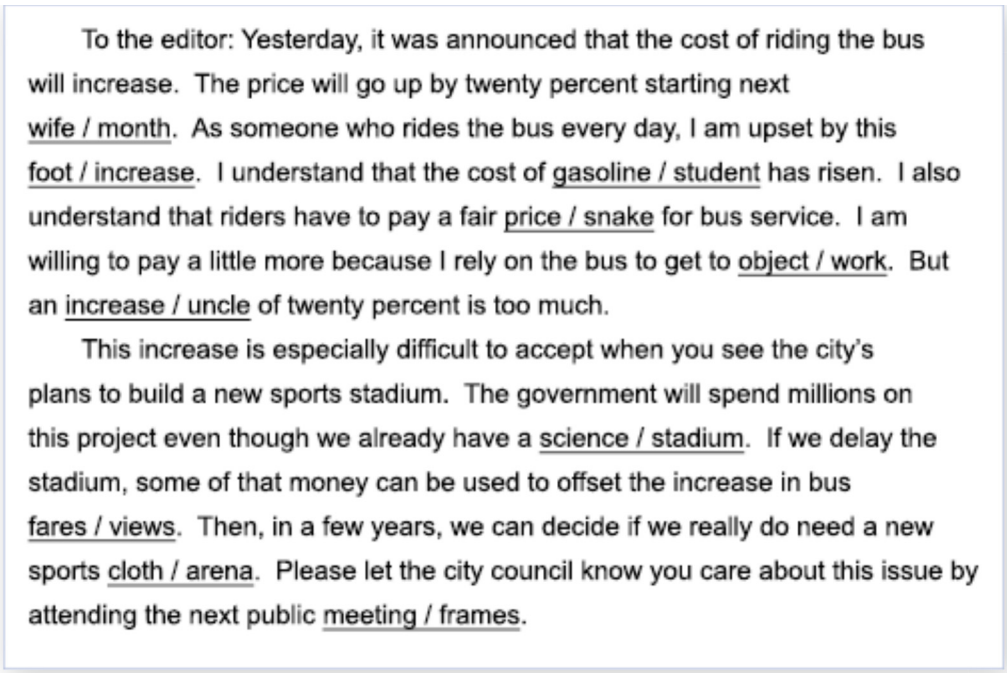

Figure 3. *Sample passage comprehension items.*

IMPLEMENTATION OF READING COMPONENTS IN THE PIAAC SURVEY

The PIAAC survey was administered via computer for most adults, but a subsample of adults was routed to a paper-based pathway. The design and procedures for assigning the computer- versus paper-based instrument to adults were somewhat complex.[38] Adults were branched to the paper-based pathway if they lacked any computer experience, failed a core block of basic computer literacy or numeracy skills, or simply opted not to take the survey via computer. Reading components were administered to all adults who took the paper-based pathway, regardless of their literacy proficiency level. Across the entire 23-country PIAAC sample, 91% of the adults who took the paper-based pathway passed the literacy/numeracy core and therefore completed a literacy or numeracy block as well as the reading component tasks. Thirty-one percent of the adults on the paper-based pathway scored at or below Level 1 (versus 15.5% total across the full 23-country sample). Thus, the paper-based subsample had a higher proportion of at or below Level 1 adults than the full, combined sample.

The literacy proficiency scores of adults who took the paper-based pathway are on the same scale as adults who took the computer-based pathway.[39] However, the reading components scores could not be put on the general literacy proficiency scale, because the paper-based subsamples were not random subsamples of the full country samples.

Consequently, we do not discuss reading components scores in terms of cross-country population estimates, but rather relative patterns of reading component mean scores within and across the common international literacy proficiency score scale levels.

The reading components tasks always were administered after the adults completed the literacy/numeracy core and assessment blocks. The reading components booklet began with simple instructions read to the adult by the survey administrator. The three task sets always appeared in the same order—print vocabulary, sentence processing, and passage comprehension. For the print vocabulary task, the administrator read the directions: "Circle the word that matches the picture you see." Two items appeared on each page. The administrator started the timer when the individual turned the page for the first item, then stopped it when the adult completed the final item.

For the sentence processing task, the administrator read the directions: "Please read each sentence, then circle YES if the sentence makes sense, or circle NO if the sentence does not make sense." Then, the adult was asked to complete three practice items. The 22 items appeared across two printed pages, with 13 on the first page and nine on the second. The administrator started the timer when the adult turned the page for the first item, then stopped it when the individual completed the final item.

For the passage comprehension task, four passages were administered. The administrator read the directions: "Read the following articles. When you come to two words that have been underlined, circle the one word that makes the sentence make sense." The administrator started the timer when the adult turned the page for the first item, then stopped it when the individual completed the final item. The public PIAAC datasets report three separate time estimates, one for each passage (with the last two passages combined into one time, presumably because they were shorter in length).

Table 1 shows the total items per reading components task set, the number of choices for each item in the specific reading components subtest, and the approximate total score for an adult scoring at chance levels. That is, an adult who could not read at all and guessed at every item was likely to receive by chance a total score of about 8 to 9 for print vocabulary, 11 for sentence processing, or 22 for passage comprehension. This should be taken into account when interpreting mean total scores or percentage correct on components for different proficiency levels. Analyses were conducted using IEA Analyzer 3.1.1[40] and SPSS.[41] The software is designed to apply iterations of analyses with plausible values. Weights were applied as appropriate.

TABLE 1. *Total items, number of choices, and chance level performance for reading component task sets*

Reading Component	Total Items per Set	No. of Choices per Item	Chance Level Total Score	Chance Level Percentage Correct
Print Vocabulary	34	4	8-9	24-26%
Sentence Processing	22	2	11	50%
Passage Comprehension	44	2	22	50%
Total (Sum) All Items	100	2 or 4	41-42	41-42%

RATIONALE FOR COUNTRY SAMPLE USED IN THIS REPORT

Unlike when translating the tasks on the main reading literacy survey, translating reading component items across languages may result in different item level difficulty estimates. The relationship between the oral form of the language and its written form may be a determining factor in how easy or difficult it is to learn to read in that language. Some languages may be easier to learn than others, perhaps because the print-to-sound correspondences are highly regular or transparent, making it easier to learn to sound out words once one knows the basic pronunciation key for decoding in that language. This may in turn be reflected in a higher prevalence of adults who show some basic reading skills in one language versus another, because even very basic instruction will yield productive literacy skills. Similarly, differences in syntactic or morphological structures in a language may influence ease or difficulty in interpreting phrases or sentences.

As our main interest in this report is understanding the U.S. adult population, we chose to include English-speaking countries (United States, Canada, United Kingdom,[42] and Ireland) as the international comparison reference group. By including English-speaking countries, we can be assured that differences in performance levels of groups are reflective of differences in the population and its educational opportunities, not differences in the relative difficulty of learning to read in the particular language.[43] For Canada, which administered the survey in French and English, we included only those who were administered the English-language test.

We also included Italy and Spain in this international comparison, because Italian and Spanish are known to have highly regular sight-to-sound correspondences, which, all things being equal, should make it easier to learn to read in these languages. On the other hand, the populations of these two countries had among the lowest overall performance levels of all 23 countries. Thus, they provide an opportunity to investigate the hypothesis that there is a relative advantage in acquiring foundational reading component skills in these languages even though overall these countries fare less well across the higher proficiency levels in the literacy skills assessed in the main survey.

RESULTS

As a first step, we estimated the prevalence of adults with low reading literacy skill levels on the PIAAC general literacy scale for each country. Table 2 shows the estimated percentage of adults in a country by proficiency level for the six countries analyzed in this report (Sample), as well as for the 23 countries (International) in the full (computer-plus paper-based samples) PIAAC sample. In the subsample of six countries, the estimated size of the population below Level 1 or at Level 1 are 4.7 and 15.8, respectively, with Spain and Italy showing larger percentages of their respective populations at or below Level 1. Note that the six-country subsample (Sample) has a higher average percentage of adults in comparison to the 23-country full PIAAC sample (International) both at Below Level 1 (4.7 versus 3.3) and at Level 1 (15.8 versus 12.2). Table 3 shows the same information but for the paper-based subsamples only. Note the higher percentage of adults at lower proficiency levels in the paper-based pathway only in comparison to the full PIAAC sample. This shows that the procedures for routing adults to the paper-based pathway were somewhat effective in directing more adults with lower literacy proficiencies toward the paper-based instruments. Nonetheless, about 60% of the Sample group has proficiency levels of Level 2 or higher.

In the remainder of the report, we will only report analyses using the six-country, paper-based pathway subsample (Sample) to facilitate comparison among the English-speaking countries, along with Italy and Spain. In subsequent tables and figures, we continue to position the Sample mean after the U.S. and Canada samples to facilitate visual interpretation, because this is the position where the subsample mean generally falls. Thus, the reader can estimate the magnitude of difference between the U.S./Canada and the Sample means.

TABLE 2. *Percentages of population by literacy proficiency level (paper and computer pathways)*

Countries	Below Level 1	Level 1	Level 2	Level 3	Level 4/5
United States	3.9	13.6	32.6	34.2	11.5
Canada	3.8	12.6	31.7	37.3	13.7
Sample	4.7	15.8	36.0	32.9	9.2
Ireland	4.3	13.2	37.6	36.0	8.5
United Kingdom	3.3	13.1	33.2	35.9	13.1
Spain	7.2	20.3	39.1	27.8	4.8
Italy	5.5	22.2	42.0	26.4	3.3
International	3.3	12.2	33.3	38.2	11.8

Note: Sample = United States, Canada, United Kingdom, Ireland, Italy, Spain; International = 23 countries that participated in PIAAC 2011 Survey.

TABLE 3. *Percentages of population by literacy proficiency level (paper pathway only)*

Countries	Below Level 1	Level 1	Level 2	Level 3	Level 4/5
United States	15.0	31.4	35.5	16.1	1.9
Canada	11.3	23.1	34.8	23.7	2.0
Sample	10.9	26.2	38.7	20.5	2.1
United Kingdom	10.3	23.7	37.5	23.0	1.3
Ireland	5.8	19.2	43.0	28.1	3.9
Italy	9.2	29.5	43.2	16.7	1.5
Spain	14.0	30.2	38.2	15.6	2.1
International	8.1	22.9	39.8	24.9	4.3

Note: Sample = United States, Canada, United Kingdom, Ireland, Italy, Spain; International = 23 countries that participated in PIAAC 2011 survey.

READING COMPONENT SKILL PERFORMANCE ACCURACY

Tables 4-7 and Figures 4-5 display the average percentage correct scores for each of the reading components task sets and the sum across all three task sets by proficiency level. As one can see, there was a significant increase for each of the reading components (print vocabulary, sentence processing, and passage comprehension) as reading literacy proficiency level increased. One can also observe that the trajectory on reading components scores reaches an asymptote for adults with proficiency levels 3 and above. Mean performance at these higher levels of literacy proficiency is generally 95% or higher on each task set. In the remainder of the report, we will only show results up to Level 3 for simplicity of presentation.

It is somewhat encouraging that the mean performance on print vocabulary (Table 4), even for the U.S. adults below Level 1, was well above chance levels at 77% correct. However, the U.S. means were lower than English international counterparts, and also lower than Italy and Spain, both at and below Level 1.

TABLE 4. *Percentage correct by literacy proficiency level for print vocabulary*

Countries	Below Level 1	Level 1	Level 2	Level 3
United States	77	89	95	98
Canada	82	90	95	98
Sample	86	93	97	98
United Kingdom	88	95	98	98
Ireland	89	94	96	98
Italy	90	94	96	98
Spain	91	96	98	99

Note: Sample = United States, Canada, United Kingdom, Ireland, Italy, Spain.

For sentence processing (Table 5), U.S. adults were at chance levels of performance, while their English counterparts' mean percentage correct ranged from 64% to 71%. U.S. adults at Level 1 also had lower means than their international counterparts. There continued to be a mean difference in sentence processing tasks even at Level 2, with U.S. adults only achieving parity with other countries at Level 3 or above. Note that Italy and Spain showed higher average levels of performance than the English-speaking countries.

TABLE 5. *Percentage correct by literacy proficiency level for sentence processing*

Countries	Below Level 1	Level 1	Level 2	Level 3
United States	52	72	87	95
Canada	64	80	89	96
Sample	69	83	91	95
United Kingdom	69	81	92	95
Ireland	71	85	92	95
Italy	79	89	94	96
Spain	80	89	94	96

Note: Sample = United States, Canada, United Kingdom, Ireland, Italy, Spain.

For passage comprehension, Below Level 1 U.S. adults were again at chance levels of performance, while their English counterparts' mean percentage correct ranged from 59% to 69% (Table 6). U.S. adults at Level 1 also showed mean differences in comparison to international counterparts. In general, there was a drop in relative performance for passage versus sentence for Below Level 1 adults across countries. This mean difference in passage reading attenuated some at Level 1 and more so at Level 2.

One may have noticed that sentence and passage reading means were closely aligned across the higher levels of literacy proficiency, with passage means sometimes higher than sentence means toward the higher proficiency levels. This is because the most difficult sentence items are typically more difficult than any of the passage items. Thus, even adults who are relatively more proficient may still make errors on these challenging sentence items while likely finding all passage items relatively easy to answer.

TABLE 6. *Percentage correct by literacy proficiency level for passage comprehension*

Countries	Below Level 1	Level 1	Level 2	Level 3
United States	47	73	90	98
Canada	59	79	90	97
Sample	62	81	92	97
United Kingdom	69	82	95	98
Ireland	63	85	94	97
Italy	64	79	90	96
Spain	71	85	95	97

Note: Sample = United States, Canada, United Kingdom, Ireland, Italy, Spain.

Table 7 shows the percentage correct summing all three component task set scores (total items = 100). The results showed the same general pattern, confirming the relatively lower performance levels at and below Level 1 for U.S. adults in comparison to the other countries in this sample.

TABLE 7. *Percentage correct for sum of all three reading component task sets*

Countries	Below Level 1	Level 1	Level 2	Level 3
United States	59	78	91	98
Canada	68	83	92	97
Sample	72	85	94	97
United Kingdom	76	86	95	97
Ireland	74	88	94	97
Italy	76	86	93	97
Spain	80	90	96	97

Note: Sample = United States, Canada, United Kingdom, Ireland, Italy, Spain.

Figures 4 and 5 graphically show the percentage correct means for each reading component by reading literacy proficiency levels. The scale range is the same on all three charts for ease of evaluating the magnitude of difference in performance across the component tasks. Recall that chance performance on the print vocabulary measure is about 25%. In general, the U.S. adults at and below Level 1 had lower scores on each of the reading components than the other groups in the sample, with English-speaking Canada scoring next lowest in all comparisons. Italy and Spain, despite larger percentages of their populations scoring at or below Level 1 overall, trended toward relatively higher reading component scores than the English-speaking countries in print vocabulary, reflecting perhaps that acquiring basic word reading skill is relatively easier in the languages of these countries because of strong correspondence of the written to spoken language. This advantage was not found in the sentence processing or passage comprehension task sets. Future research will need to be conducted to test alternate explanations for this pattern.

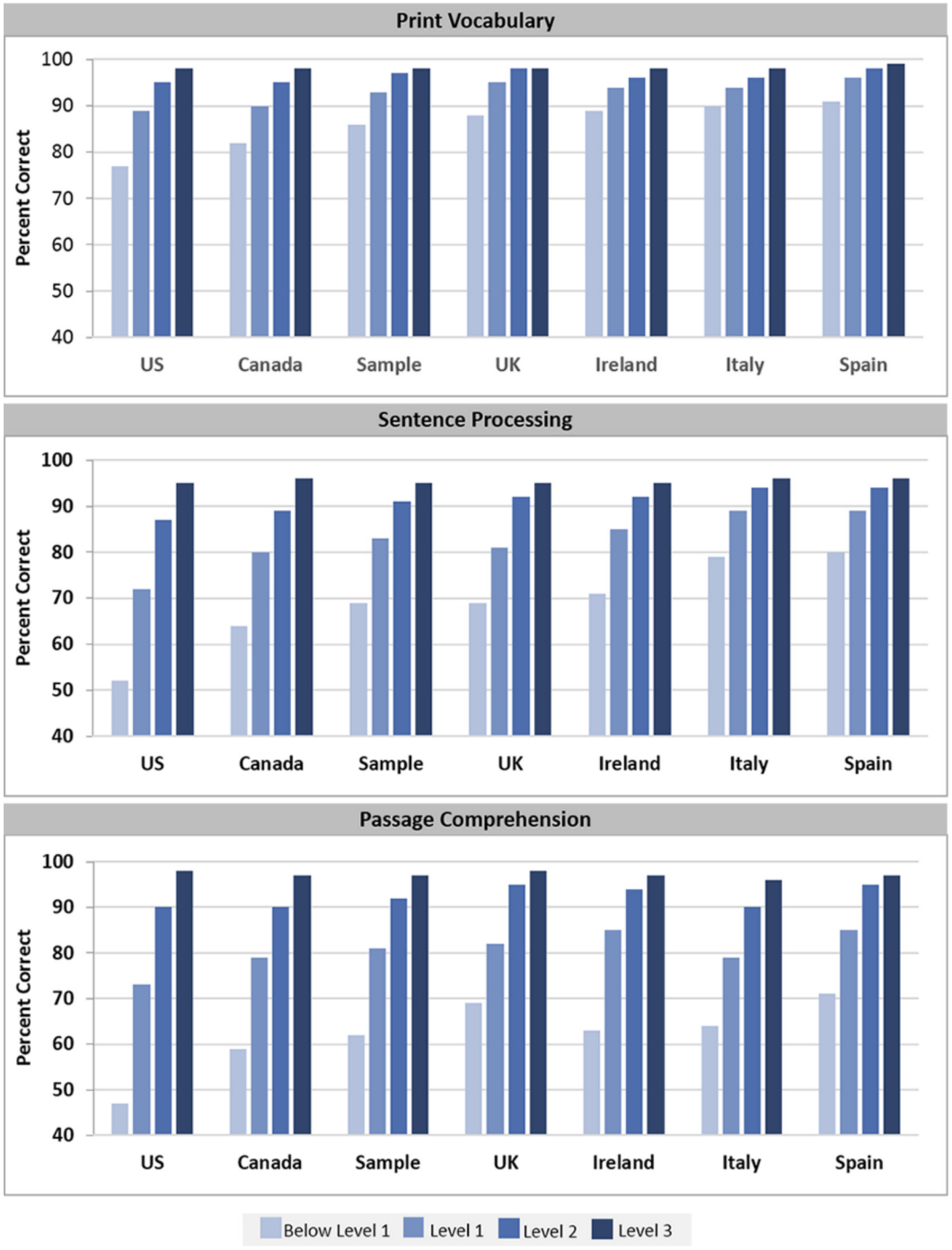

Figure 4. *Charts showing country percentage correct on print vocabulary, sentence processing, and passage comprehension by literacy proficiency levels.*

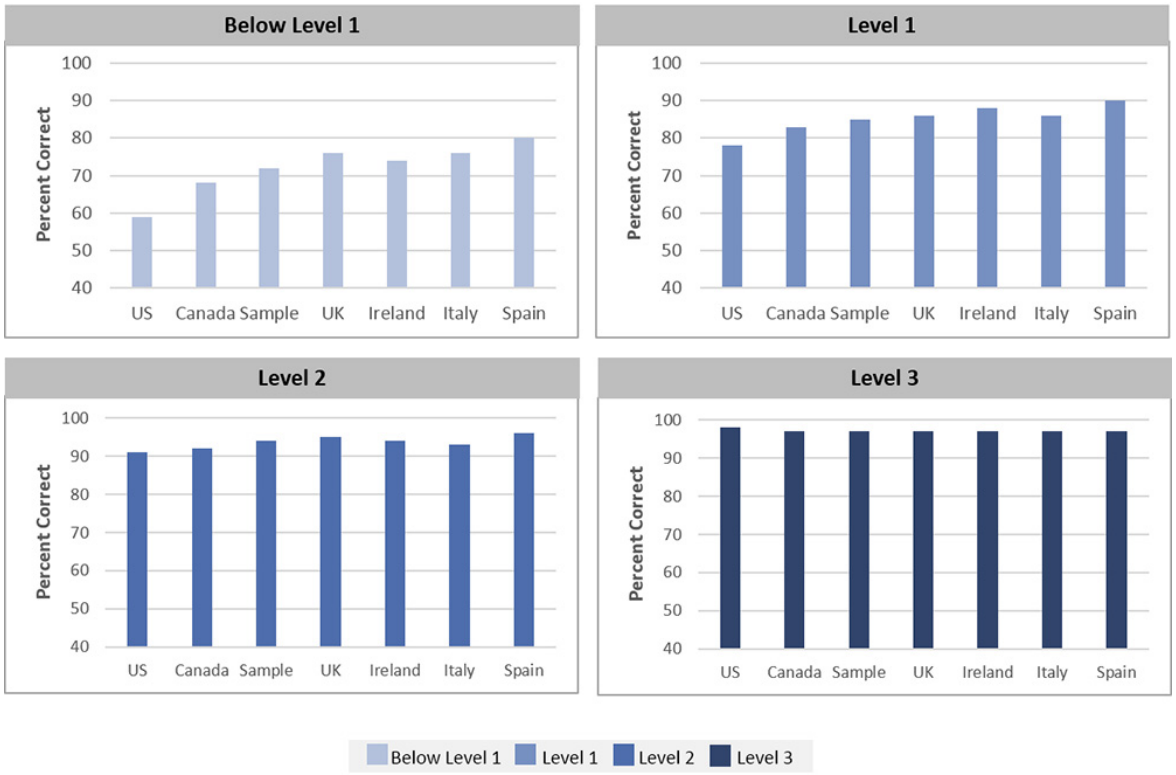

Figure 5. *Chart showing country percentage correct for sum of all three component skill task sets by literacy proficiency levels.*

READING COMPONENT SKILL PERFORMANCE: TIME TO COMPLETE TASK SETS

Next, we computed the average time (in minutes) to complete each of the reading components task sets and the total time summed across all three task sets (see Tables 8-11).[44] As one can see, there was a significant decrease in time to complete each of the reading components (print vocabulary, sentence processing, and passage comprehension), as reading literacy proficiency level increased. Unlike percentage correct scores, which reached an asymptote for adults at proficiency Level 3 and above, the mean rate of response continued to decrease across the entire ability distribution (not shown). This is to be expected. As reading component skills become more accurate, rate of processing text becomes more efficient.

TABLE 8. *Time (in minutes) by literacy proficiency level to complete print vocabulary task set*

Countries	Below Level 1	Level 1	Level 2	Level 3
United States	4.5	3.2	2.3	1.8
Canada	4.1	3.0	2.5	2.0
Sample	3.9	3.0	2.4	2.0
United Kingdom	3.9	3.1	2.5	2.2
Ireland	3.8	2.9	2.3	2.0
Italy	3.7	3.2	2.7	2.3
Spain	3.5	2.7	2.2	1.8

TABLE 9. *Time (in minutes) by literacy proficiency level to complete sentence processing task set*

Countries	Below Level 1	Level 1	Level 2	Level 3
United States	3.9	3.4	2.9	2.2
Canada	4.5	3.8	3.1	2.5
Sample	3.9	3.3	2.8	2.3
United Kingdom	3.9	3.1	2.7	2.3
Ireland	3.4	3.1	2.6	2.3
Italy	3.9	3.5	2.9	2.5
Spain	3.8	3.1	2.6	2.2

TABLE 10. *Time (in minutes) by literacy proficiency level to complete passage comprehension task set*

Countries	Below Level 1	Level 1	Level 2	Level 3
United States	8.4	7.8	6.1	4.8
Canada	8.9	7.7	6.4	5.0
Sample	8.5	7.4	6.1	5.0
United Kingdom	8.5	6.8	5.8	4.7
Ireland	7.5	6.5	5.5	4.8
Italy	8.7	8.1	7.0	5.9
Spain	9.0	7.4	6.0	5.0

TABLE 11. *Time (in minutes) by literacy proficiency level to complete reading component task set*

Countries	Below Level 1	Level 1	Level 2	Level 3
United States	15.0	13.5	11.0	8.6
Canada	16.2	13.5	11.4	9.2
Sample	15.0	13.0	11.0	9.1
United Kingdom	14.9	11.9	10.4	8.8
Ireland	13.0	11.9	10.2	8.9
Italy	15.4	14.4	12.5	10.5
Spain	15.4	12.8	10.5	8.8

Unlike the percentage correct data, the U.S. results for timing data were not so different from other countries in the sample. What is important to note is the magnitude of the increase in time to complete tasks for the Below Level 1 and at Level 1 groups. Skilled adults read continuous English prose text at an average rate about 200 to 250 words per minute with good comprehension.[45] Readers may slow down their rate when the text is highly complex, they are unfamiliar with the topic, they are trying to learn or study, or they need to think critically about a question or problem related to the text.[46] However, given the difficulty level of the reading component tasks, a good reader would not need to slow down very much. Hence, the reading components are an index of reading ease, automaticity, and fluency. In fact, the sentence task format is very similar to other tests used as indicators of a reading fluency construct.[47]

If we set Level 3 as a reference point for a typical, skilled adult reader, then we can estimate the relative additional time required for readers at lower proficiency levels to complete the task set. Table 12 shows these ratios. As the table indicates, the sample country mean at Level 2 was about 20% (country range 14% to 27%) slower than the Level 3 group mean. This increased to an average of 42% slower at Level 1 (country range 33% to 57%) and 64% at Below Level 1 (country range 46% to 75%).

TABLE 12. *Ratio of time to complete reading component task set with Level 3 as reference time (denominator)*

Countries	Below Level 1	Level 1	Level 2	Level 3
United States	1.75	1.57	1.27	1.00
Canada	1.77	1.48	1.24	1.00
Sample	1.64	1.42	1.20	1.00
United Kingdom	1.69	1.35	1.18	1.00
Ireland	1.46	1.33	1.14	1.00
Italy	1.46	1.37	1.18	1.00
Spain	1.76	1.46	1.20	1.00

NATIVE AND NONNATIVE SPEAKERS

How did native versus nonnative speakers of the test language perform on reading components task sets?[48] Figure 6 compares native (left column) versus nonnative (right column) speaker groups for print vocabulary, sentence processing, and passage comprehension by literacy proficiency levels. These charts show that the U.S. mean difference in reading components was strongly associated with the low performance of nonnative English speakers in the United States. When comparing only native speaking groups (left column) across the country sample, the U.S. Below Level 1 group had scores comparable to the international sample average in print vocabulary (92% to 90%), still relatively lower in sentence processing (72% to 76%), and much lower in passage comprehension (66% to 76%). At Level 1, the same pattern of results was evident.

However, when one examined nonnative speaker performance (right column), the U.S. difference increased dramatically in comparison to the other country samples. Below Level 1, nonnative speakers of English in the United States had average percentage correct scores of 68% on print vocabulary, 39% on sentence processing, and 35% on passage comprehension.

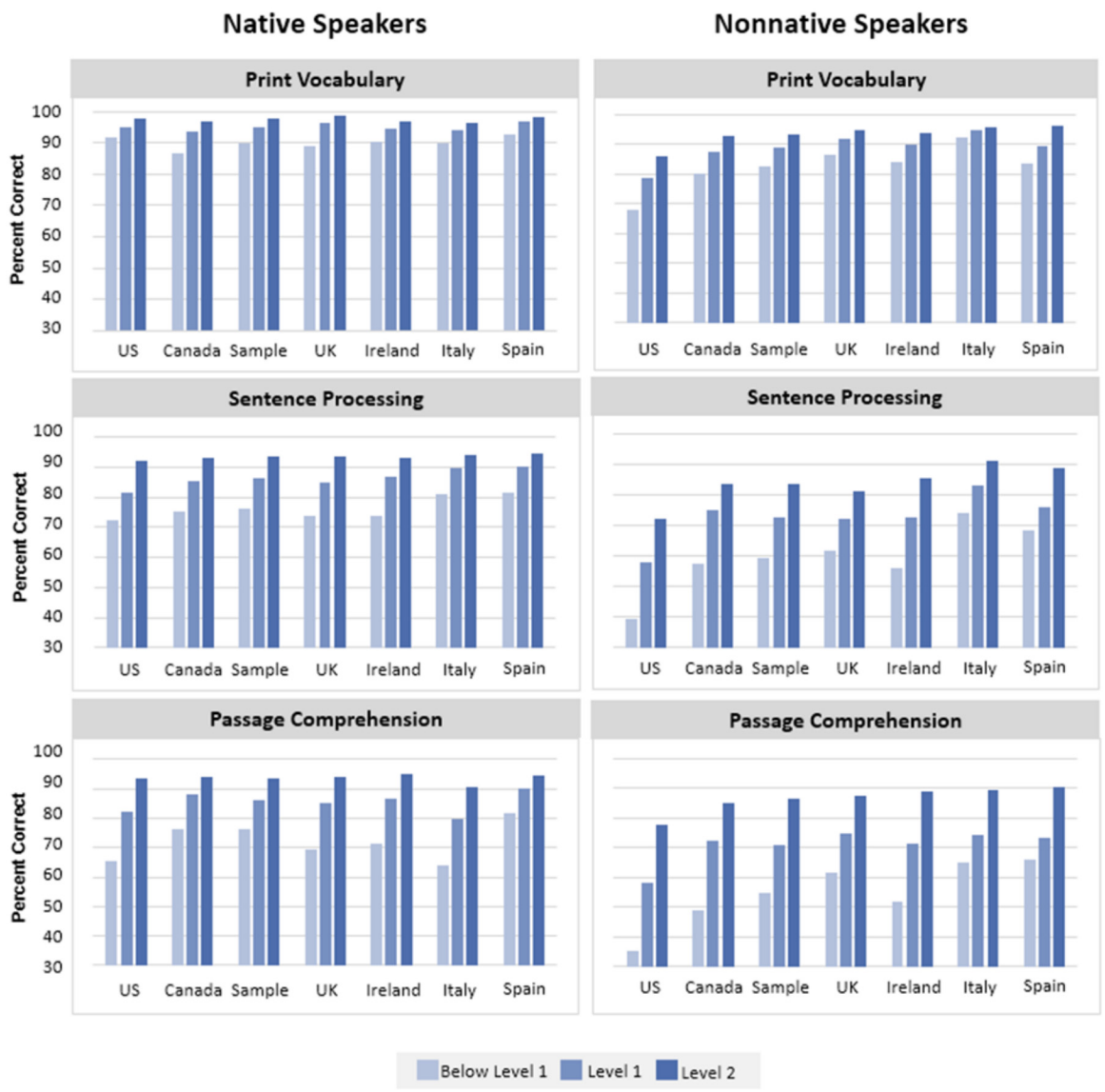

Figure 6. *Charts showing country percentage correct for native and nonnative speakers of a language for print vocabulary, sentence processing, and passage comprehension by literacy proficiency levels.*

COMPUTER EXPERIENCE

The score difference between those with computer experience versus those without was largest for those scoring below Level 1 (Figure 7), with the mean difference closing as proficiency increased. Table 13 shows how the difference between those with and without self-reported computer experience varied with proficiency level. As Table 13 shows, the mean difference diminished with proficiency. The U.S. difference was largest in the sample, and this difference was relatively greater than other countries across each proficiency level.

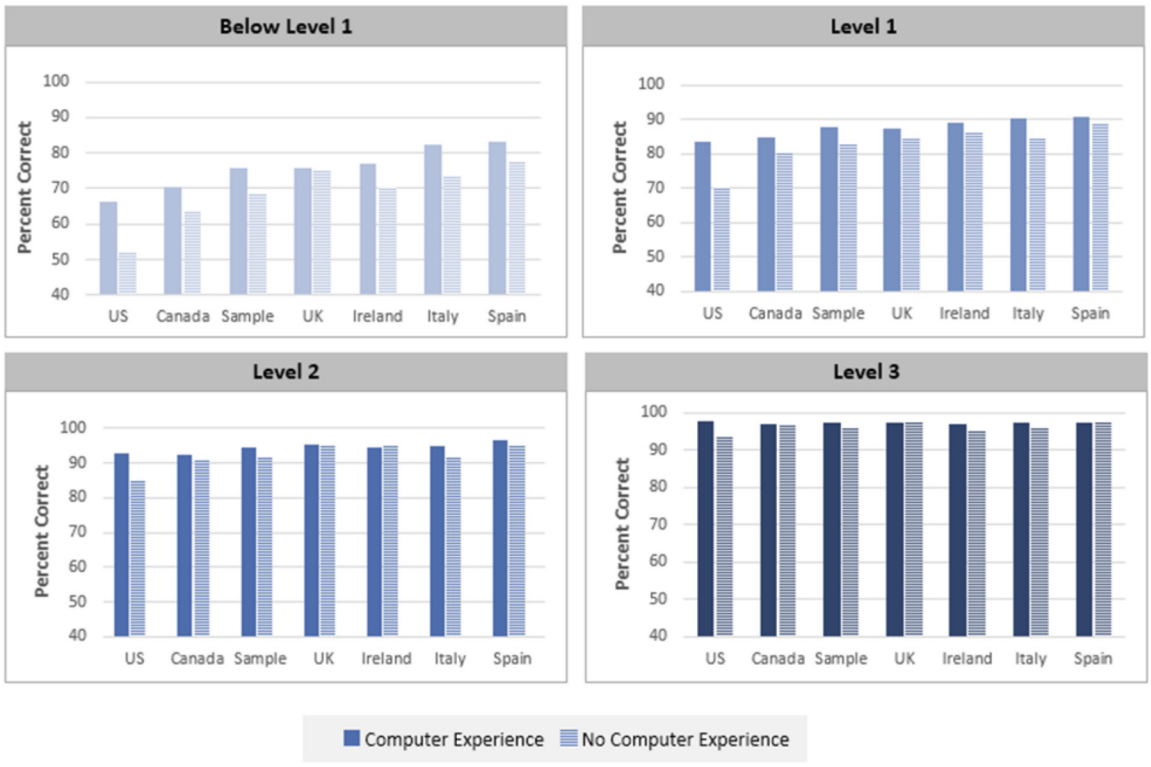

Figure 7. *Computer experience by country group mean differences on total for all reading components by proficiency level for Yes versus No (computer experience).*

TABLE 13. *Mean difference in total reading component score by computer experience (Yes-No experience)*

Countries	Below Level 1	Level 1	Level 2	Level 3
United States	15.0	13.0	8.0	4.0
Canada	7.0	5.0	1.0	0.0
Sample	7.0	5.0	2.0	1.0
United Kingdom	1.0	3.0	1.0	0.0
Ireland	7.0	3.0	0.0	2.0
Italy	9.0	6.0	3.0	2.0
Spain	5.0	1.0	2.0	0.0

RELATIONS AMONG READING COMPONENTS AND GENERAL READING LITERACY PROFICIENCY

To further understand the relations between reading components and proficiency, we computed correlations among the variables for the six-country subsample. The correlations were computed using the entire subsample that took the paper-based assessment pathway, not just adults at or below Level 1. As one can see in Tables 14-15, there were moderate to strong correlations among the reading component scores, and small to moderate correlations to literacy scores for adults across the entire distribution for both the United States and six-country sample proficiency levels. However, the relationships were strongest for the U.S. population. Stronger correlations of the components to proficiency is consistent with an interpretation that weak component skills are continuing to impact overall literacy proficiency performance.

The tables also show that the times to complete task sets were negatively correlated, although the magnitude of the correlations were smaller than were the reading component accuracy scores. A negative correlation shows that as individuals are higher on the proficiency scale, their time decreases—evidence of fluency and automaticity. In part, this weaker correlation may be a consequence of error associated with the measurement of time using the paper-based administration procedures. However, as we shall see in the next analyses, total time is a contributor to the overall relationship to reading literacy proficiency scores, even after accounting for reading component accuracy scores.

TABLE 14. *Correlations among literacy proficiency score, reading components accuracy, and time to complete reading component task sets for U.S. sample*

United States	Literacy Score	Print Voc	Sent Proc	Pass Comp	Time Print Voc	Time Sent Proc	Time Pass Comp
Literacy Score	1						
Print Vocabulary	0.33	1					
Sentence Processing	0.48	0.77	1				
Passage Comprehension	0.47	0.69	0.81	1			
Time - Print Vocabulary	-0.39	-0.16	-0.29	-0.32	1		
Time - Sentence Processing	-0.29	0.14	0.12	0.06	0.49	1	
Time - Passage Comprehension	-0.25	0.19	0.15	0.24	0.29	0.66	1

Note: Time = time to complete task set, Print Voc = print vocabulary, Sent Proc = sentence processing, Pass Comp = passage comprehension.

TABLE 15. *Correlations among literacy proficiency score, reading components accuracy, and time to complete reading component task sets for six-country sample*

Six-Country Sample	Literacy Score	Print Voc	Sent Proc	Pass Comp	Time Print Voc	Time Sent Proc	Time Pass Comp
Literacy Score	1						
Print Vocabulary	0.23	1					
Sentence Processing	0.39	0.63	1				
Passage Comprehension	0.38	0.49	0.64	1			
Time - Print Vocabulary	-0.27	-0.04	-0.15	-0.18	1		
Time - Sentence Processing	-0.28	0.04	0.00	-0.04	0.40	1	
Time - Passage Comprehension	-0.28	0.03	0.02	0.09	0.30	0.64	1

Note: Time = time to complete task set, Print Voc = print vocabulary, Sent Proc = sentence processing, Pass Comp = passage comprehension.

Another way to understand the relation of reading components to overall proficiency is to look at how strongly the components are related to literacy proficiency scores. The regression models in Table 16 were computed using the entire six-country sample that took the paper-based assessment pathway, not just adults at or below Level 1. That is, we included all adults who were administered reading components regardless of predicted literacy proficiency score. Because accuracy scores reached an asymptote around Level 3, we can infer that reading components accuracy scores predict literacy scores most strongly for adults below this level. This assumption will not necessarily hold for the timing data, as we observed that there was a decrease in average time across the entire ability distribution.

With literacy proficiency score as the dependent variable, Table 16 shows variance accounted for by print vocabulary (PV), sentence processing (SP), and passage comprehension (PC), the combination of the three, and finally with timing information included. Print vocabulary accuracy showed the weakest relation to literacy scores. This most likely reflects the near-ceiling performance levels at and beyond Level 2. Sentence

processing and passage comprehension, on the other hand, showed a modest but significant relationship across the ability range.

Adding the variance of vocabulary and sentence together (column PV+SP) added a little to the variance, and adding the passage scores (column PV+SP+PC) increased the strength of the relationship further. Finally, including the time to complete information (column All RC+Timer) made a large, significant contribution to the relationship, with an international average of 30% of the variance accounted for by the component skill scores. Note also that there was relatively little between-country variation in the relation between components and literacy scores, except for a stronger relationship in the U.S. sample. As noted previously, stronger associations of the components to proficiency scores is consistent with an interpretation that weak component skills are continuing to impact overall proficiency for adults, particularly in the U.S. sample.

TABLE 16. *Multiple regression model showing adjusted R-squared values with literacy proficiency scores as dependent variable and combinations of reading components (RC) scores and time to complete reading component tasks as independent variables*

Country	PV	SP	PC	PV+SP	PV+SP+PC	All RC + Timer
United States	0.10	0.23	0.23	0.24	0.27	0.42
Canada	0.06	0.19	0.16	0.20	0.22	0.36
Sample	0.04	0.14	0.13	0.14	0.17	0.30
United Kingdom	0.07	0.17	0.14	0.18	0.20	0.33
Ireland	0.03	0.12	0.12	0.13	0.15	0.22
Italy	0.03	0.09	0.11	0.09	0.13	0.23
Spain	0.05	0.11	0.13	0.12	0.15	0.26

Note: PV=Print Vocabulary; SP=Sentence Processing; PC=Passage Comprehension; Timing= total time across all three component task sets.

REVIEW OF KEY FINDINGS

In this report, we reviewed how reading components are related to literacy levels, focusing on Below Level 1 and Level 1 proficiency. We described the rationale and theoretical foundations for including reading components in the PIAAC survey. We chose a sample of English-speaking countries (United States, Canada, United Kingdom, and Ireland) so that we could compare U.S. performance to other countries where adults learn to read in English. We also included Spain and Italy, because the sight-to-sound systems of Spanish and Italian are more transparent than in English, potentially making it easier to learn foundational skills in these languages than in English. On the other hand, these countries scored near the bottom of the cross-country literacy comparison internationally. Key results concerning the United States adults and six-country sample included the following:

- **General**: The U.S. Below Level 1 and at Level 1 groups consistently scored below the other English-speaking countries in the sample, as well as below Spain and Italy. In most analyses, by Level 2, the U.S. results were comparable to other countries. All countries' results were near asymptote levels on reading components by Level 3.
- **Print Vocabulary**: The U.S. average percentage correct for print vocabulary lagged behind the six-country average for Below Level 1 (77% vs. 86%) and Level 1 (89% vs. 93%) before showing comparably high performance at Level 2 (95% vs. 97%). On the positive side, the performance was well above chance levels, suggesting that even Below Level 1 U.S. adults could recognize printed forms of words associated with common objects such as animals, furniture, and shapes.
- **Sentence Processing**: In the sentence processing task set, the United States lagged even further behind the six-country average for Below Level 1 (52% vs. 69%), Level 1 (72% vs. 81%), and Level 2 (87% vs. 91%) before reaching parity at Level 3 (95% for both). With chance performance at about 50%, this indicates that many Below Level 1 adults in the United States were not able to understand and evaluate even short sentences.
- **Passage Comprehension**: In the passage comprehension task set, the United States again lagged far behind the six-country average for Below Level 1 (47% vs. 62%) and at Level 1 (73% vs. 81%), before reaching parity at Level 2 (90% vs. 92%). With chance performance at about 50%, this indicates that many Below Level 1 adults in the United States were not able to read

passages for basic understanding. In general, Below Level 1 adults performed relatively lower on the passage comprehension task set than on the sentence processing, but by Level 1, mean performance levels were comparable between these two reading component task sets.

- **Reading Components Rate**: With respect to time to complete the task sets, the United States was not disproportionately slower than the other countries in the sample. In general, differences in accuracy of performance were all reflected in speed or rate for completing task sets across the entire ability distribution. This suggests that fluency or automaticity of component skill processing is part of the underlying foundation of literacy for most adults. That is, Below Level 1 adults needed more time to achieve their levels of performance than Level 1 adults, who themselves needed more time than Level 2 adults, and so on across Levels 3, 4, and 5.
- **Nonnative Speakers of the Test Language**: A significant proportion of the difference between the United States and the other countries in the six-country sample could be attributed to the relatively poorer performance of the nonnative English-speaking subgroup in the U.S. sample. For the United States alone, nonnative speakers had lower mean performance scores than native English speakers across the summed total of the three component tasks at Below Level 1 (47% vs. 76%), Level 1 (65% vs. 86%), Level 2 (79% vs. 95%), and even at Level 3 (92% vs. 98%), before reaching parity at Level 4/5 (99% for both groups). The nonnative speakers in the U.S. sample generally performed lower than nonnative speaker subpopulations in other countries in the sample. In general, nonnative speaker groups in countries scored lower than native speakers. This pattern of results is consistent with the interpretation that performance on reading components tasks may be negatively impacted by weakness in individuals' language ability in the test language. The overall impact on national means would vary as a function of the relative size of the nonnative-speaking subpopulation in each country.
- **Native Speakers of Test Language only**: Comparing only native-speaking adults across the sample, the U.S. results were comparable to the six-country averages. For percentage correct scores (summed across the three task sets), the United States versus six-country sample results were: Below Level 1 (76% vs. 78%), Level 1 (86% vs. 89%), and Level 2 (95% for both). In the United States, native speakers of the test language who were Below Level 1 had performance levels of 92%, 72%, and 66% for print vocabulary, sentence processing, and passage comprehension, respectively. Although the United

States native-speaking English sample scored comparable to the other sampled countries, this pattern still demonstrated weaknesses in reading component skills for at or below Level 1 U.S. adults (as well as in the other countries).

- **Computer versus No Computer Experience**: In general, there was a mean difference between adults who reported some computer experience versus those reporting no computer experience, but this mean difference diminished by Level 2 or 3 literacy proficiency level in most other countries in the sample. By contrast, the mean difference based on computer experience in U.S. adults persisted across proficiency levels. Note that this result was based entirely on the paper-based pathway subsample in which adults were administered the main assessments and reading components in paper booklets. That is, computer experience was associated with higher literacy scores on the paper-administered instruments.
- **Associations among Reading Components and Literacy Proficiency Scores**: Correlations among variables showed a small to moderate association between reading component accuracy and literacy proficiency, with a relatively larger association for sentences and passages than vocabulary. A negative correlation was found for the time to complete reading component task sets, indicating that as proficiency increased, the time to complete the tasks decreased.
- **Multiple Regression Models**: These models demonstrated the theoretically predicted relationship between reading component accuracy and rate with literacy scores. The model for the international average showed a small amount of variance (4%) predicted by print vocabulary alone, more with sentence processing (13%) or passage comprehension (14%) alone, and 17% when all three were used together. Adding the time to complete information resulted in a stronger relationship (30%) across the entire ability distribution, confirming the association of efficient (accuracy plus rate) text processing as skill levels increase. The relationship was relatively stronger in the U.S. sample in comparison to the six countries sampled.

DISCUSSION AND IMPLICATIONS FOR POLICY AND PRACTICE

In this section, I first contextualize the results of this study as they relate to broad policy considerations. This is followed by some more specific instructional recommendations for developing foundational skills in adults, drawn primarily from the reading and learning science literature.

While developing advanced reading literacy proficiency requires practice applying skills in real-world settings, basic skill development additionally may require direct skill instruction and practice applying nascent skills in exercises that build up fluency of application of those skills. Consequently, understanding adults' performance on foundational skill tasks, such as those represented in the reading component task sets, provides different types of information than is gathered from adults' patterns of responses to applied reading literacy tasks, as represented in the main literacy survey tasks. By assessing foundational skills directly, the reading components results provide new information for practice and policy beyond general reading proficiency level scores. One can draw some implications for instructional programs from these results when coupled with the research literature on teaching adult learners.

What policy implications can we draw from the basic science and empirical evidence of effective instruction for helping adults who still demonstrate foundational reading skill weaknesses to become better readers?

The good news that stems from the PIAAC reading components battery results is that adults in the United States who scored at literacy proficiency Level 3 or above (and the vast majority at Level 2) demonstrated near-ceiling level performances on reading component task sets, suggesting well-developed foundational reading skills. There was also some cause for optimism in the generally competent performance of many U.S. adults who were at or below Level 1, at least for native English-speaking U.S. adults. The performance of this group in recognizing high-frequency print vocabulary and evaluating the meaning of simple sentences demonstrated some basic literacy skills. The results, however, also revealed continued weaknesses in foundational skills for adults scoring below Level 1, and for many scoring at Level 1, in accuracy, but especially in fluency and automaticity of processing.

The reading components results are consistent with the claim that fluent, efficient basic skills are foundational in supporting development of more advanced literacy skills.[49] Learning, especially formal learning that may occur in education or training programs, often includes learning new content and skills through evidence-based instruction. Empirical studies in the reading and learning sciences over the past several decades have yielded a rich literature for understanding reading processes,[50] sound

pedagogical approaches to learning to read,[51] and descriptions and insights into dyslexia and reading disability, when development goes awry.[52] The research is richest for young children but substantial in describing and seeking to understand those who struggle to read in adolescence and adulthood, as documented in a recent National Academies of Research Committee report.[53] What implications can be drawn from this literature?

For one, we can conclude that it is unlikely that it will be easier and quicker for low-skill adults to learn to read fluently and well compared to what one would expect of children learning to read. The small number of studies that have attempted to accelerate adult reading progress via well-designed, research-based intervention programs have reported significant but modest gains,[54] which is similar to results obtained with adolescent, in-school struggling readers.[55] Direct instructional interventions of 200 hours or less have not been found sufficient for helping adults at levels equivalent to Below Level 1 or Level 1 to achieve high levels of literacy.[56] Thus, targeted instruction and practice is effective but not a quick fix. This has policy implications for the expectations set for literacy programs with respect to learner achievement gains and the provision of learning and instructional duration and intensity.

Specifically, stakeholders need to be realistic about the progress one can expect in the short term from instructional programs. Further, policies need to be more sensitive to what it means to be an adult lifelong learner. It seems unlikely that thousands of hours of classroom instruction is a feasible policy alternative for delivering instruction to adults with skills at or below Level 1. Nor is it likely that adults would participate in such programs. Research shows that adult learners often have intermittent periods of self-study and program participation across the life span.[57] In contrast, the interconnected, digital literacy world could bring services and tailored support to adults across intermittent periods of self-study and program participation. The promise of this type of adaptive instruction has been anticipated for decades,[58] but perhaps now the circumstances are right for this promise to be realized or at least revisited. Digital technologies could provide both instructional support, remotely delivered, and access to the thousands of hours of immersion with text that may be necessary for adults to achieve higher reading levels. But for such a recommendation to be feasible, both access and readiness to use digital literacy tools needs to be established.

In addition, before we draw more dour conclusions about the instructional and the provision of time that low proficiency adults may require to achieve high levels of literacy proficiency, perhaps it is worth rethinking what is required (and provided) for children to acquire literacy proficiency. U.S. primary school children that are on a

developmental trajectory that would eventually lead to college and career readiness typically still require two to three years in an immersive, daily reading literacy instructional and practice environment (that is, grades 1 to 3 of primary school) before becoming relatively fluent readers of simple texts. By grade 4, these normally developing learners (i.e., at the 50th percentile or above on a reading fluency measure) are reading fourth-grade level texts aloud at a rate of about 90 to 120 words per minute.[59] Most fourth-grade level texts employ high frequency words and simple, short sentences. They are less complex in vocabulary, sentence, and discourse structure than middle-grades expository text that are used to teach subject domains such as history or science.[60] Nonetheless, with frequent exposure and practice reading a wide variety of text structures and genres in each successive year (that is, grades 4-12), students on this fluency trajectory can expect to see their reading rate increase to average about 250 words per minute during silent reading of average adult-level prose texts.[61]

This typical 12-year, immersive, developmental learning program may seem infeasible for adult education, but adult learners have their entire lives to traverse this learning space. Policy formulations should draw upon the reading and learning sciences literature, take advantage of digital technologies, and be more sensitive to what it means to be a lifelong learner.

The results of such formulations may challenge the assumptions of current infrastructure and funding priorities of the adult education field as it exists today, with perhaps a stronger emphasis on digital technologies. Toward this end we note again, however, that U.S. adults who reported no computer experience scored lower on the reading components, even though those reading components tasks were administered as a paper-based instrument. Given that so much personal, workplace, and commercial reading literacy takes place on or is migrating to electronic devices (e.g., smartphones, tablets, personal computers), and the promise and potential of digital literacy as part of the policy solution for adult education provision, the PIAAC results concerning computer experience of U.S. adults is a most troubling finding. Further research needs to be conducted to understand the source of this difference. Reder, for example, in an examination of the general PIAAC survey results, discussed pathways toward digital literacy and equity issues with respect to access and readiness to achieve high levels of digital literacy.[62] He concluded that inequities exist based on race/ethnicity and national origin—a problem that policies could be designed to confront.

This is an appropriate segue to another central result revealed in the reading components analyses. A significant proportion of low-scoring U.S. adults were also nonnative speakers of English. Research, policies, and literacy programs will continue

to need to prioritize understanding and serving the learning needs of nonnative English speakers in the United States. The current Workforce Innovation and Opportunity Act of 2014[63] does stipulate policies to fund programs for integrated English literacy and civics education including reading, writing, speaking, and comprehension skills in English. The law specifically refers to the term "essential components of reading instruction" as used in the Elementary and Secondary Education Act.[64] It further goes on to encourage the development and use of promising assessment tools and strategies that are based on scientifically valid research to identify the needs of nonnative-speaking students at the lowest achievement levels. The evidence reported here confirms the need for further attention and research on effective learning strategies and assessments for nonnative speakers of English in the United States.

What instructional implications might be drawn for adults with weak foundational reading skills?

For adults who continue to experience challenges at the **word level** (including not only the breadth and depth of their vocabulary, but also fluent and automatic decoding and word recognition), adapting methods used when teaching beginning readers (or analogous methods for English language learners) may be appropriate.[65] For example, Greenberg et al.[66] report deficits in adult learner vocabulary relative to grade-matched children, suggesting that weaknesses in word recognition and learning skills may impede normal development of the breadth and depth of adult vocabulary.[67] A growing body of research also suggests that morphological awareness, and morphology knowledge and skills more generally, is related to reading comprehension, as well as the subskills that underlie reading.[68]

For adults who continue to experience challenges at the **sentence level**, the root causes could include both inefficiencies at the word level as noted above and other semantic and syntactic processes. Complex sentences often have multiple embedded phrases and clauses that increase the distance between subjects and predicates, a feature known to increase processing demands.[69] Key to understanding complex sentences, and perhaps instructionally malleable, is efficient processing of connectors. Relationships that are signaled in connectors may be temporal (e.g., before), causal (e.g., because), adversative (e.g., although), or conditional (e.g., if). Empirical studies have been conducted examining the difficulties learners often have in adequately processing these kinds of semantic[70] or syntactic relations.[71]

For adults who continue to experience challenges at the **passage comprehension level**, a strong instructional program might involve varying the linguistic complexity of texts that the individual reads and providing opportunities for discussion of texts of

increasing length and complexity.[72] Continuous texts can also include the range of meaning relationships that are represented in the sentence processing items—referential, causal, and knowledge-based relationships among discourse entities.[73] Adult learners can discuss their understanding of texts or try to summarize or explain it to others, whether to themselves, a teacher, or other adult learners.[74] This interactive discussion may reveal errors in interpretation and can help readers build awareness and fluency in encoding sentence meaning for increasingly complex sentence and text structures.[75]

To build adults' reading fluency and stamina, literacy instruction should include opportunities for frequent practice with reading. Repeated reading of familiar texts is a technique that has been shown to help build reading fluency.[76] Proficient readers typically read widely and have the stamina and perseverance to read lengthy texts (e.g., novels) yet are still able to retain in memory a general mental model of what they have read. The passage tasks model that kind of continuous reading practice and therefore serve as indicators of an adult's readiness for learning and instruction with longer, continuous texts.

Finally, helping low-skill adults to increase their reading proficiency will likely benefit from contextualized instruction, taking advantage of the broader knowledge of the world and relevant interests of the adult learners. Isolating all instruction on components is not likely to be as effective as finding the appropriate mix for each adult.[77]

Though not directly addressed in PIAAC, research on individuals with learning, mental, or physical disabilities should be considered when interpreting the results here, as it is likely that the scores of some segment of the sampled individuals may have been impacted by preexisting learning, mental, or physical conditions, with consequences for the instruction or policies that will be effective in helping them to enhance their reading abilities.[78]

CONCLUSIONS

In conclusion, reading components provide a more refined profile of the foundational reading skills adults possess when attempting to complete literacy tasks. The generally competent performance of many U.S. adults who were at or below Level 1 is cause for some optimism, at least for native English-speaking U.S. adults. However, the relatively lower performance of adults at or below Level 1 in comparison to other English-speaking countries, especially nonnative speakers of English in the United States, remains a cause for significant national concern and a call to action. Further, the strong, consistent association between increases in accuracy with decreases in processing speed across the entire ability distribution would suggest that instructional or training programs should strongly encourage extended practice and engagement with text to enhance the ease, speed, and efficiency with which adults process written text, consistent with cognitive research on expert skill development.[79] Further research employing reading component assessments can help uncover how best to identify and support this segment of the U.S. population.

We remain hopeful that substantial progress in enhancing the literacy abilities of adults with low skills in the United States can be achieved. But the evidence here and extant research suggest that it will require a comprehensive and sustained effort and investment on the part of the adult learners and the programs and policies designed to support them.

ENDNOTES

[1] OECD (Organisation for Economic Co-operation and Development), *OECD Skills Outlook 2013: First Results from the Survey of Adult Skills* (Paris: OECD Publishing, 2013).

[2] OECD, *Time for the U.S. to Reskill? What the Survey of Adult Skills Says* (Paris: OECD Publishing, 2013), http://skills.oecd.org/Survey_of_Adult_Skills_US.pdf.

[3] OECD and Statistics Canada, *Learning a Living: First Results of the Adult Literacy and Life Skills Survey* (Paris: OECD, 2005).

[4] Donald J. Leu, Elena Forzani, Chris Rhoads, Cheryl Maykel, Clint Kennedy, and Nicole Timbrell, "The New Literacies of Online Research and Comprehension: Rethinking the Reading Achievement Gap," *Reading Research Quarterly* 50 (2015): 1-23.

[5] See, for example, Irwin Kirsch, Henry Braun, Kentaro Yamamoto, and Andrew Sum, *America's Perfect Storm: Three Forces Changing Our Nation's Future* (Princeton, NJ: Educational Testing Service, 2007).

[6] OECD and Statistics Canada, *Literacy in the Information Age: Final Report of the International Adult Literacy Survey* (Paris: OECD Publishing, 2000), http://www.oecd.org/edu/skills-beyond-school/41529765.pdf; OECD, *Learning a Living*.

Below Level 1 of the literacy proficiency levels is described as follows: 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 was noncontinuous 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 (OECD, *OECD Skills Outlook 2013*, 4).

Level 1 of the literacy proficiency levels is described as follows: Most of the tasks at this level require the respondent to read relatively short digital or print continuous, noncontinuous, 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 noncontinuous 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 (Ibid.).

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[14] For more information on the PIAAC Reading Literacy frameworks, see OECD, 2012, *Literacy, Numeracy*, or PIAAC Literacy Expert Group, *PIAAC Literacy: A Conceptual Framework*, OECD Education Working Papers No. 34 (Paris: OECD Publishing, 2009), http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?doclanguage=en&cote=edu/wkp%282009%2913.

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[39] OECD, *OECD Skills Outlook 2013*.

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[42] United Kingdom results refer to England and Northern Ireland only, the two entities reported on for PIAAC. For PIAAC, results for England and Northern Ireland were reported separately at the request of the United Kingdom. For the purposes of this report, such a distinction is unnecessary.

[43] Note, however, there will be differences associated with the prevalence of nonnative speaker subpopulations with low skills in a country. Nonnative speakers may face distinct challenges learning to read in the target language of the survey. Native versus nonnative speakers are analyzed later in the report.

[44] We omitted times that were less than 20 seconds for any single component task. We also reset all times that were beyond 2.5 standard deviations of the mean of each reading component task set to the value at 2.5 standard deviations. This reduced the extreme values at either end of the timing distribution.

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[48] The native versus nonnative (NATIVESPEAKER) variable is derived based on responses to the background questionnaire. The respondent was considered a native speaker if his or her first language was the assessment language.

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