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PIAAC Reading Component: A Conceptual Framework

John P. Sabatini, Kelly M. Bruce

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PIAAC READING COMPONENTS: A CONCEPTUAL FRAMEWORK

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By John P. Sabatini and Kelly M. Bruce
Educational Testing Service, USA

Contact: William Thorn; E-mail: William.THORN@oecd.org; Telephone: +33.145.24.78.04

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ABSTRACT

Governments and other stakeholders have become increasingly interested in assessing the skills of their adult populations in order to examine how well prepared they are to meet the challenges of the modern knowledge-based society. The current paper provides a conceptual framework for the assessment of reading component skills in the OECD's Programme for the International Assessment of Adult Competencies (PIAAC). The assessment of component skills is intended to provide a greater level of information about the skills of individuals with low levels of literacy proficiency than has been available from previous international assessments. The 'component skills 'identified for the assessment are vocabulary knowledge, sentence processing and passage comprehension.

RÉSUMÉ

Dans la région OCDE tout comme en dehors, les pouvoirs publics et autres parties prenantes s'intéressent de plus en plus à l'évaluation des compétences de la population adulte dans un objectif de suivi de sont état de préparation face aux défis de la société moderne de la connaissance. Le présent article fournit un cadre conceptuel pour les éléments de lecture du Programme pour l'évaluation internationale des compétences des adultes (PIAAC). S'appuyant sur les principes et processus de base de la lecture, il définit les compétences à l'écrit ainsi que les tâches de l'évaluation afin de permettre une meilleure compréhension des savoir-faire en lecture inhérents à des niveaux élevés de compréhension des textes. Ce cadre cherche à créer une évaluation qui assure la comparabilité entre les pays et établisse une idée plus claire de ce que signifient les profils de lecture des adultes en haut de l'échelle des compétences en compréhension des textes.

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FOREWORD

i. As noted in the PIACC Literacy Framework (PIACC Literacy Group, 2009), although the Components Framework is seen as somewhat independent in the PIAAC plan, we regard it as integral to the full overall Literacy Framework.

ii. The authors would like to acknowledge and thank the Literacy Expert Group who provided comments and recommendations for revisions on multiple iterations of this document, and especially to Stan Jones, Chair of the Expert group. We would also like to express our considerable appreciation to Irwin Kirsch, Kentaro Yamamoto, and Juliette Mendelovits for their feedback and support.

iii. Members of the Literacy Expert Group:

- Stan Jones (Chair) – Canada
- Egil Gabrielsen - Norway
- Jan Hagston - Australia
- Pirjo Linnakylä - Finland
- Hakima Megherbi - France
- John Sabatini - USA
- Monika Tröster - Germany
- Eduardo Vidal-Abarca - Spain

PIAAC READING COMPONENTS: CONCEPTUAL FRAMEWORK

INTRODUCTION

1. The Components Assessment Framework described in this report builds upon the basic principle that comprehension, that is, 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. This basic principle of learning to read has now been widely researched and accepted internationally (Curtis, 1980; Oakhill, Cain, & Bryant, 2003; Perfetti, 1985, 2003; Sabatini, 2003; Strucker, Yamamoto, & Kirsch, 2004). Evidence of an individual's level of print skill can be captured in tasks that examine a reader's ability and efficiency in processing the elements of the written language – letters/characters, words, sentences, and larger, continuous text segments.

2. A second principle guiding the components design is that the main interest is in whether the adults surveyed can apply their existing language and comprehension skills to the processing of printed texts. The components tasks are not designed to separately assess the level of language skills in the target print literacy writing system, nor the literacy skills assessed in the main literacy survey. If the adults surveyed are non-native speakers of the target language, and do not have basic oral vocabulary, syntactic/grammatical, and linguistic comprehension skills, then that will result in poor performance on component reading tasks. We cannot differentiate low language skills from low literacy skills in the component tasks.

3. A third principle of this model of reading is that the level of proficiency, efficiency, and integration of component skills is indicative of level and learning potential in reading development. As skills and knowledge accumulate, the ease of processing of familiar, text-based print increases. Component efficiency is typically indexed by assessing speed or rate of processing, as well as accuracy. As learners, we spend extra time, effort, and energy to solve problems that are novel. On familiar tasks, we can often respond accurately, quickly, with seemingly little conscious effort. When the tasks are easy, we can spend more effort solving and learning from more complex problems and tasks. Speed or rate can be approximated by recording the time it takes to complete certain tasks or by setting a time limit and observing how many items are completed in the time frame allotted.

4. Finally, two guiding assumptions of this assessment framework are made. The first is that the adults to be sampled are in the low end of the continuum of reading ability (as evidenced by low performance on the screening instrument). The model of reading acquisition, development, and choice of item types and difficulties described below holds most strongly in this range of non- and developing readers. Different assumptions about component inter-relationships may hold for a population of more skilled readers.

5. The second assumption is that the set of component items administered in each country will reflect the linguistic characteristics of the language of assessment. As the relationship of the language to the writing system may be very different in different languages, the nature of the items used to assess the components will need to be adapted based on consideration of those differences. This will best ensure comparability across languages. A base set of components items in English and the guidelines for translation and adaptation are provided in a separate document.

Measuring component skills

6. The primary goal of the component skills battery is to help us better understand the "reading" profiles of adults at the low end of the literacy spectrum. In designing these measures in English, we can adopt the assumptions of the simple view of reading to organise our assessments to maximise useful profile information. As described by Hoover & Tunmer (1993): "the simple view makes two claims: first, that reading consists of word recognition and linguistic comprehension; and second, that while each of these components is necessary for reading, neither being sufficient in itself." (p.3) Word recognition is a stronger predictor of reading level in the early years of reading development. As word recognition becomes more fluent and automatised, listening comprehension becomes a stronger predictor of reading ability, though word recognition continues to contribute significant variance even in skilled readers (Gough & Walsh, 1991; Cunningham, Stanovich, & Wilson, 1990; McCormick, 1994). Strucker, Yamamoto, & Kirsch (2003) use a similar component framework when they describe *print components* (e.g., decoding accuracy and fluency) and *meaning components* (e.g., oral vocabulary).

7. In skilled reading, these components are integrated to support literacy performance. Even during acquisition of reading skill, the components do not strictly develop hierarchically. One learns to understand basic sentences and paragraphs, even as one learns individual words and how to decode. One does not wait to 'master' decoding skills before learning to construct meaning. However, during acquisition, the components may be measured separately, with different profiles having implications for learning, instruction, and policy.

8. Nonetheless, a foundation of *decoding* and *word recognition* skills is necessary (albeit not sufficient) to enable the growth in proficiency of meaning/comprehension level skills. However, the decoding/word recognition components are highly dependent on the precise nature of each language to its writing system. Aspects that affect difficulty in development of learner proficiency include whether the writing system is alphabetic, syllabic, logographic, or some combination; the degree of regularity of the relationship between the print and oral language forms; and how morphological and grammatical/syntactical features of the language are encoded in words. For these reasons, it is difficult to ensure cross-language comparability, as this requires evaluating how to match the sources of difficulty in acquiring these print skills for each language, and balancing them across stimuli and tasks.

9. *Vocabulary*, *sentence*, and *basic passage* understanding in print comprise the meaning based component skills we will assess. We discuss each component in more detail in the following sections, along with how they depend on and may be linked back to the more basic print skills of decoding and word recognition as appropriate.

FRAMEWORK OF READING COMPONENTS

10. Conceptually, we begin this discussion of the reading components framework with the basic print skills (alphanumeric perception and efficiency and word recognition/decoding), but it should be noted that these are optional parts of the components assessment.[1] The components to be assessed are word meaning (print vocabulary), sentence processing, and basic passage comprehension.

Alphanumeric

11. Visual recognition of the printed elements of the alphabet is a core prerequisite of reading ability development in alphabetic writing systems. It remains a significant predictor of early reading acquisition in the U.S. (Adams, 1990). Part of this is explained by the obvious need of visual recognition of the letters to understand oral instruction. If an instructor asks the learner to find the word that begins with the letter 'bee', then the learner must identify the visual symbol from the auditory label. This is the most basic step of sight-to-sound correspondence – matching the letter name to the printed symbol and vice versa. Even observing that not all the letter names correspond to letter sounds (e.g., the letter name of 'w' is pronounced 'double-you') in English and that different languages have different names for letters (e.g., in German 'b' is pronounced 'bay') does not change the fundamental value of knowing this sometimes arbitrary set of associations.

12. However, just accurately being able to puzzle out the names of letters is not as indicative as also demonstrating easy, quick, and seemingly effortless performance, i.e., automatisation, in processing this important symbol system. This latter skill level serves as a foundation for a) benefiting from oral instructional settings, and b) focusing attention on higher level skills. In the context of a broad survey it is indicative of individuals' experience with the writing system either through schooling or attempts at reading print. From data collected in the U.S. and elsewhere, the rate of rapid naming of alphanumeric symbols remains moderately correlated with overall reading skill across developmental and adult levels (e.g., Sabatini, 2002; van den Bos, Zijlstra, & Spelberg, 2002).

13. Rapid naming of alphanumeric lists can be used as basic reading measures, as well as covariates for better understanding profiles or eliminating extraneous variance from inferences we might wish to make about subgroups. The main types of information provided by these tasks are as follows.

- Index of familiarity with basic perceptual codes of the writing system. (Numbers and letters will be over-learned symbol systems and frequent exposure to them should result in efficient perceptual identification.)

- Index of baseline pronunciation rates.

14. Rapid naming of letters and of numbers have typically been administered as separate tasks. Letters are a slightly stronger predictor of reading than numbers, but both tasks are generally more strongly correlated with each other than with overall reading ability. This pattern from the research literature holds because frequent exposure to printed texts in rich text settings (e.g., in schools, workplaces) typically involves exposure to both letters and numbers. However, it is possible that in some settings, such as

[1] While we do not provide a base set of decoding/word recognition items in English, we discuss how to develop such items and tasks below, so that each country interested in assessing these foundational print skills can design them. Participating countries that wish to assess alphanumeric perception and word recognition/decoding will find development guidelines in a separate document.

communities with minimal printed materials available, exposure and knowledge of printed digits is higher than for letters or vice versa. This highlights the value of measuring both independently, rather than assuming one can be a proxy for the other. Therefore, we recommend both letter and digit recognition tasks when this assessment is used.

Decoding and visual word recognition

15. Most models of reading development recognise the centrality of rapid, automatic visual word recognition to reading ability (Abadzi, 2003; Adams, 1990; Perfetti, 1985). The visually presented printed real word (a spelling or orthographic representation in alphabetic languages) is transformed by the perceptual-cognitive system for processing into semantic (meaning) and phonological (sound-based) code systems. It is widely documented that the sound-based code is used in phonological working memory during the process of meaning construction or comprehension (Gathercole & Baddeley, 1993).

16. The semantic and phonological systems described for reading are the same cognitive systems used in language comprehension more generally. This forms the basis for the claim that visual word recognition 'feeds' the more general language processing system that also is used when listening to language or internal speech (Perfetti, 2003). Put another way, the goal of word recognition is to permit the individual to use the full extent of their language skills to construct meaning or comprehend as early in the cognitive processing of print as possible.

17. Without going into great detail on the mechanisms of word recognition (which are still under study in the psychological sciences), there are two basic behavioral skills that are indicative of proficiency in word recognition. The first is the accumulation of sight word knowledge of real words in the language. In English, one can identify a relatively smaller set of words that appear frequently in everyday texts, as compared to all words in the language that one might find in a dictionary. Most of these frequent printed words are words most skilled speakers of a language have in their speaking/listening lexicon/vocabulary.[2] Accurate and rapid recognition of frequent words is a strong index of word recognition efficiency and proficiency.

18. The second, more fundamental skill is decoding (also referred to as *word attack* or *cyphering*). This skill enables the generation of plausible pronunciations of printed words and conversely, plausible phonetic spellings of heard words. Decoding has been described as the fundamental word learning mechanism in alphabetic languages (Share, 1997), and therefore an essential component to measure directly. In alphabetic systems, decoding requires knowledge and skills in how lexical and sublexical sight-to-sound correspondences represent words in the language. Acquiring mastery of this skill is somewhat easier in languages in which the sight-to-sound correspondences are highly regular and predictable (e.g., German, Serbo-Croatian, Spanish, Turkish). With only a modest input of instruction, learners in these languages can often generate pronunciations for novel printed words and produce the correct pronunciation (i.e., the pronunciation that matches the typical spoken form in the language).

19. In languages with less regular correspondences, there are many alternate pronunciations for any given spelling (and vice versa), so more learning and instructional effort may be required to achieve proficiency. For example, the 'ou' vowel sound is pronounced differently in the English words 'could', 'though', 'thought', 'found'. In contrast, 'word', 'bird', 'heard', 'curd', 'nerd' all rhyme when pronounced, but the vowel sound is represented visually by different letters.

[2] This line of reasoning begins to get more complicated as one tries to categorise grammatical and morphological features in determining what counts as a word. For example, a dictionary will not list every verb tense as a separate meaning, though visually and auditorily they are different. In general, morphological, grammatical and syntactic variations across languages interact with word recognition in different degrees as well.

20. As noted, sight recognition of frequent printed words is a direct index of the accumulated knowledge of word reading. Several sources are available for getting an approximate list of these frequent words in English (e.g., Kucera and Francis, 1967). The ability of an individual to read a selected sample of such frequent, well known words without the benefit of passage context is a useful index of how many words an individual can recognise in print. However, one cannot tell based solely on accuracy whether the words were processed more like sight words or decodable words. The distinction is one of degree as much as kind. A sight word is a printed word that has been seen often enough by the individual that it is recognised 'by sight', in contrast to a novel or pseudoword in which one must apply one's decoding knowledge of sight-to-sound correspondences to generate a pronunciation.

21. In skilled reading, both skills are necessary and applied rapidly, automatically, and strategically as needed. If one only measured decoding skill, one might have an estimate of the growth potential for learning real words, but under or overestimate accumulated knowledge of sight word knowledge directly necessary to reading and understanding printed texts. If one only measured sight word knowledge, then one might under or overestimate the growth potential. For example, low literate adults in the U.S. have been found to have sight word knowledge of frequent English words gleaned from years of formal schooling and exposure to printed text that overestimates the decoding knowledge and skills they can apply to learning novel words. Though they have some functional literacy ability, their reading growth seems to be stunted by their slow progress in learning new sight words (Davidson & Strucker, 2002; Greenberg, Ehri, & Perin, 1997, 2003; Sabatini, 2003).

22. Therefore, in the components measures for word recognition in English and other alphabetic languages that are less regular, sight word and decoding tasks can be separated. However, when the spelling system is highly consistent, predictable, and regular, it may be more efficient to use one or the other type assessment.

Word meaning (print vocabulary)

23. Very simply, a barrier to understanding what one reads is not knowing the meaning of the printed words. One can infer meanings of unknown words from context (while reading or listening), but this typically produces provisional, uncertain, and incomplete word meanings – the understanding of which must be separately verified (e.g., checking definition in a dictionary).

24. In the component skills framework, we seek to determine whether individuals can identify in print, words in the everyday listening lexicon of average adult speakers of the language. That is, the emphasis is on the everyday words of the language, rather than specialised technical or academic words that may be known by some but not most of the population. This would be the language used in the neighborhood or market. It would be the language of popular media such as newspaper, radio, and television. This is the most cross-country, comparable vocabulary. The purpose of the vocabulary component measure of this survey, then, is not so much to measure the full extent of individual's vocabulary knowledge, so much as determining whether individuals could understand words when reading print that they could otherwise understand when listening to those words.

25. How do decoding and word recognition affect print vocabulary knowledge? As reading skill develops, one would expect a greater facility in learning new words from print whether or not one hears them used in oral language contexts. *Decoding* skill is critical to this word learning function of reading (for generating plausible pronunciations and storing memory traces), as well as strong reading comprehension skills (for inferring meaning from context). One would also expect that high-frequency, familiar words in the language will be recognised with ease and automaticity in print as one's reading skill increases. When we use the term *word recognition*, we refer to the memory trace of words that one sees in print frequently. So, both basic decoding and word recognition are pre-requisite to print vocabulary skill,

though they are not the same as knowing the word meanings. As each vocabulary task will ask adults the meaning of printed words, the primary construct is vocabulary, with decoding and word recognition skills serving as necessary moderators of performance.

26. Assessing vocabulary knowledge can be slippery. Words have multiple meanings. Individuals can know partial meanings of words or know only a specific meaning of a word when the word is used in a specific context. For assessment purposes, many of these difficulties can be circumvented by using words that are concrete and visualisable. Such words can be made into picture vocabulary items. Respondents are shown common words in the language, then must select from several line drawings depicting common things (e.g., book, chair, cat). Or, one can show a picture and have individuals select from a set of words, the word that best matches the picture. [3] Care should be taken to select items that are expected to be well known by most adults in the population. Rare and infrequent words are useful in assessing the breadth of vocabulary across the entire population, but are less helpful in making claims about the reading vocabulary of adults with low literacy skills. Care must also be taken to select items that are known cross-culturally. For example, a 'raccoon,' which is indigenous to parts of North America, but not necessarily world wide, would not be a good candidate item for a multi-country survey, whereas the 'moon,' which is known in all countries, is a good candidate.

Sentence processing

27. A variety of psychological studies of reading show that the sentence is a natural breakpoint in the reading of continuous text (e.g., Kintsch, 1998). A skilled reader will generally pause at the end of each sentence. A variety of operations are typically performed including encoding the propositions of the sentence, making anaphoric inferences, relating meaning units to background knowledge and to previous memory of the passage as it unfolds, and deciding which meaning elements to hold in working memory. Thus, each sentence requires some syntactic and semantic processing.

28. By controlling the difficulty of the vocabulary in a sentence (i.e., use simple words the individual can recognise and knows the meaning of), one can vary the sentence complexity to get an indicator of the individual's proficiency at constructing basic meaning from print. Several measurement focal points are possible, depending on the assumptions about the population and claims one is interested in making.

- If one can assume that the population has a basic command of the grammar and syntax of the language, then the emphasis will be on whether they can apply their language skills in the context of printed text.

- If one cannot, then one may also put emphasis on assessing their basic command of the grammar and syntax of the language.

29. In the components framework, we emphasise the first point. Given a goal of cross-country comparability, varying grammatical/syntactic complexity may not be an ideal strategy, as it is difficult to create items that would be judged as equally difficult (grammatically) in different languages. The recommended strategy, as demonstrated in the examples that follow, is to vary the length of sentences

[3] A distinction is typically made between receptive versus expressive or productive vocabulary. In expressive or productive tasks, the examinee sees stimuli such as a picture and must produce the correct word. In receptive tasks, they choose the correct response from among alternatives. We have adopted the latter for several reasons. First, receptive vocabulary is generally larger than productive, so it is better suited to low ability populations. Second, constructed responses are more difficult to score objectively, as respondents may give correct answers unanticipated by the test developer, which should be credited. With choices, only one response is the best answer, even if there are other correct answers as well, disambiguating the score interpretation.

within a basic grammatical structure, and to vary the logical relationships that comprise meaning. By adding more phrases, clauses, conditions, and relations, one will increase length and processing demands, minimizing processing of more complex grammatical structures that may be specialised in languages (e.g., past perfect subjunctive).

30. Thus, in the component measure of sentence processing, sentence length or complexity is varied. The individual is asked to make a judgment whether the sentence makes sense based on the content of the sentence, either in relation to common knowledge about the world (see Example 1) or based on the internal logic of the sentence (Example 2). This task demand is consistent with the 'evaluation' goal of reading in the PIACC framework (PIACC Literacy Group, 2009). Even at the most basic reading level, as one constructs meaning from a sentence, one should evaluate that meaning against ones knowledge of the world to judge its veracity. That is, one cannot always believe what one reads. This item type thus measures a combination of basic sentence meaning processing, as well as basic comprehension monitoring and evaluation.

31. For example, one could write items such as:

- Example 1: "The sky is green." YES or **NO**
- Example 2: "If a house is taller than a person, then the person is shorter than the house." **YES** or NO

32. The primary emphasis is on whether respondents can apply their existing language skills in a reading literacy context, not on higher level vocabulary and background knowledge, syntactic/grammatical knowledge, or reasoning skills. These are critical skills for all levels of reading ability, but in the sentence component task we seek to minimise their influence. They are more robustly embedded in the tasks on the main literacy survey. At the basic reading level, we are interested in a more fundamental construction of meaning as a building block to higher level comprehension skill.

33. The simple judgment of whether a sentence is sensible is designed to focus the assessment on basic literal comprehension. However, the logical truth or falsity of basic facts in the empirical world can be slippery. One can imagine exceptions to most absolute statements. Also, language is often used figuratively and metaphorically (e.g., "The sky is grey or black" may conjure images of a storm or night time; 'The sky is pink' conjures images of a sunset.) In the item design of sentences for this component, an attempt should be made to minimise ambiguity of meaning as much as is possible.

Basic passage comprehension

34. Skilled reading is rapid, efficient, and fluent (silent or aloud). Theoretical discussions and definitions of reading fluency generally refer to three aspects of fluency: accuracy, rate, and prosody/expressiveness (Fuchs, Fuchs, Hosp, & Jenkins, 2001; Kame'enui & Simmons, 2001; NRP, 2000; Rasinski, 2006). At a minimum, reading fluency is indicating that visual word identification processes are efficiently feeding language processing systems (e.g. working memory) to produce outputs. The outputs do not necessarily imply the construction of meaning or comprehension as we commonly imagine it. Skilled readers can read familiar texts somewhat fluently aloud without attending to the meaning. However, when oral reading fluency has been operationalised as relatively error free reading of a simple passage aloud at a normal speaking rate, it has reliably served as a solid indicator of the integration of some basic component skills (e.g., Daane, Campbell, Grigg, Goodman & Oranje, 2005; Wayman, Wallace, Wiley, Ticha, & Espin, 2007). On the other hand, breakdowns in accuracy, rate, or both, suggest difficulties in other subcomponents.

35. In recent research, a silent reading assessment task design has gained empirical support as an indicator of basic reading fluency and comprehension. The design uses a forced-choice cloze paradigm, that is, a choice is given between a word that correctly completes a sentence in a passage and an option that is incorrect. The incorrect item is meant to be obviously wrong to a reader with some basic comprehension skills. Distractors may be grammatically or semantically wrong. By giving the participant only a fixed amount of time to do the task, a measure of reading efficiency and fluency is assessed. In this component assessment participants must focus attention on comprehension as they read (Samuels, 2006). Thus, the integration of decoding, word recognition, vocabulary, and sentence processing is required to construct the basic meaning of a short passage. Fluent, efficient performance on such a basic, integrated reading task is a building block for handling longer, more complex literacy texts and tasks.

36. For cross country comparability, it may be best to allow individuals as much time as necessary to complete each passage, then record total time required to complete. This is because average reading rates of skilled readers may vary from country to country, primarily as a function of language, writing system, and cultural variables. For most low skill adults, the accuracy score will be sufficient to estimate their basic comprehension ability. For the very low skilled beginning reader, the measurement falls more heavily on basic reading comprehension and the time to complete will add very little additional information about their skills.

37. However, near the top of the low ability scale, adults may reach ceiling level total correct scores. By taking into consideration total time to complete the task, we can estimate their basic reading efficiency. A skilled reader would be able to choose all correct responses quickly, without much effort, and continue on reading at a normal rate. By collecting performances from a sub-sample of skilled readers in each country, we will have a benchmark for relative scaling efficiency/fluency of these low-moderate skilled adults across countries. That is, low ability adults with high accuracy scores on this task possess some basic comprehension skills, but still differ in their efficiency in processing continuous text relative to skilled adult readers.

CONCLUSION

38. Components assessment tasks are designed to inform our understanding of the basic reading skills that underlay proficient literacy performance levels. They help us describe what low literate adults can do and therefore form a basis for learning, instruction, and policy with respect to helping low literate adults achieve higher literacy levels. In this framework, we have focused attention on those component skills that show the greatest promise for cross-country comparability, specifically reading vocabulary, sentence comprehension, and basic passage comprehension and fluency. We have also described how decoding, word recognition, and familiarity with the basic print codes of a language are related and necessary to achieving higher levels of literacy skill. Noting how the language-specific nature of these latter skills makes it difficult to construct items and tasks that are easily comparable across languages, we encourage their use nonetheless as beneficial to within country insights into learning, instruction, and policies directed at improving the achievement levels of low literate adults.

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