



Raising literacy from 20% to 80%? A Science-Based Strategy for GPE Partner Countries

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Governments and donors have been working hard to develop efficient learning programs and resolve the learning crisis. And solutions do exist, particularly as *innovations through science – cognitive neuroscience*. Research applications are most pertinent to the lowest levels of education, and this is exactly where the poor falter.

Scientific lessons have already been implemented in a few countries. GPE gave technical advice to Cambodia and the Gambia on reading (also on math); the reading pilots resulted in very satisfactory outcomes and expressions of appreciation by governments. Not surprisingly, other GPE partner countries have directly requested technical advice. With sharp messages and close coordination, the current mountain of problems can be reduced to a molehill in five years.

The outline of the strategy and the research is below. Every item is backed up by specific studies, but for the sake of simplicity this summary document omits them. These are found in the more detailed document “Literacy for All in 100 days?” by Helen Abadzi.

Raising literacy in GPE schools from 20% to 80%: The Specifics

Basic reading can be taught efficiently and quickly, by the middle of grade 1. If such an outcome seems unbelievable, it is only because reading is taught through models tailor-made for certain western European languages. English, French, Portuguese, Dutch have complex spelling systems. English in particular requires three years of learning time (French requires about two). Reading instruction for English is expensive and complex. Students must learn sight-read lists of words along with vocabulary and prediction skills to make sense of strangely spelled words. They must start reading in kindergarten and get monitoring to ensure that they read at grade level; about 10-15% require remedial instruction. Since English is an official language in many countries, literacy has been viewed as a naturally complicated process.

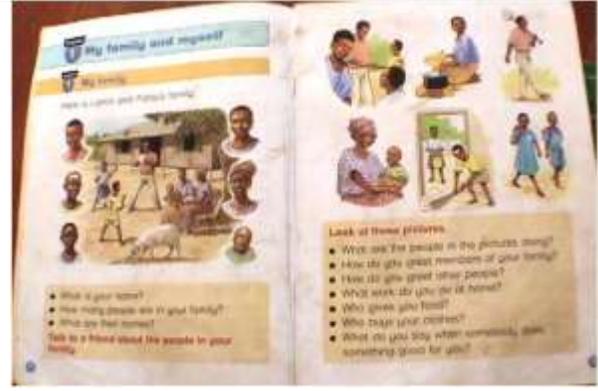
By contrast, the eastern side of Europe speaks languages that are spelled consistently. In Czech, Russian, Albanian, Greek, Serbian, Turkish (but also German and Spanish) instruction requires much simpler procedures. In earlier decades reading was taught by untrained teachers through syllabaries that unwittingly obeyed building-block learning principles. In such languages, basic instruction requires only requires only about 100 days. In the above countries of Europe, it is widely “known” that first graders typically decode by Christmas.

Like Czech or Spanish, the vast majority of the world’s languages are spelled consistently. Barring learning disabilities, nearly all students could be made basically literate by the middle of grade 1. (Basic forms only for syllabic scripts). To facilitate execution, a minimal number of the most necessary, “non-negotiable” activities have been identified. These would enable nearly all students at least to decode in local languages “by Christmas,” despite systemic inefficiencies. And according to evidence, literacy may help reduce dropout.

Strategy outline: Students are to learn basic reading in local languages within the first 100 days of grade 1. (Local languages include regional lingua francas, which in multilingual societies are learned from the environment.) At the same time, they will learn the official language orally. In

grade 2 they will receive a bridging course to transition eventually to the formal language. The many older illiterate students are to be remediated through the same 100-day program (“literate school in 100 days”) and similarly receive a bridging course to the official language. If executed approximately as planned, school illiteracy may become a thing of the past in 5 years.

One issue that is often voiced by government officials is that language of instruction for early-grade reading is desirable, but students should exit early and not spend years studying in a local language. Given the need for basic literacy, it is certainly possible to follow the policy option that governments desire.

	
<p>Former Gambian textbook, p. 1: English whole-language method, learnable mainly by the better off</p>	<p>Russian syllabary, 1915 Can be learned by all</p>

Parsimonious Literacy Instruction in 100 Days

In higher-income countries, students get exposed to print before school, so they progress fast in automaticity and text interpretation. Commensurately, the poor are expected to progress quickly into meaning and content. People learn by chunking small items into larger ones, so children who fall behind in the first few days, may never catch up. The early learning failure in low-income countries is due to missing “low level” building-block skills.

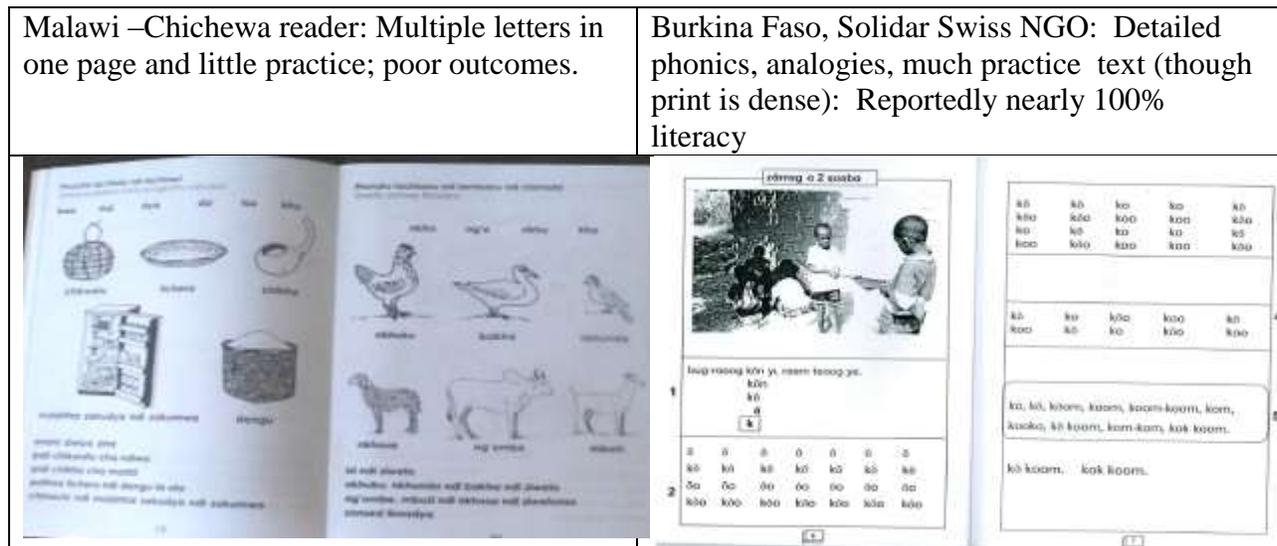
The suggested method provides the missing chunking process. During the first 100 days (about four months, 1 instructional hour per day) students are to learn the letter shapes and sounds along with the decoding strategy. After that period and for the rest of the school year they would practice with at least a page of text daily to attain automaticity. Much research shows that a minimum reading speed is needed to understand text (about 45-60 wpm across languages and scripts), and when people decipher a word in a known language, they understand it within about half a second. The program aims to gradually build reading speed in expectations that students will understand literal meaning after they can read a text fast enough to hold it in working memory.

Target: After completing the first stage of 100 days, approximately 85% of children should be able to name about 80% of letter sounds. By the end of year 1, nearly all students should be

reading, albeit at various speeds. There should be practically no students reading 0 words, as is currently common.

This program differs in some substantial ways from most others implemented worldwide. Its principles are often violated, and they lead to the learning crisis that is often observed. These are:

- Application of perceptual learning research. Teachers are to write large, spaced letters, e.g. using an entire sheet to write one letter as a flash card. *Habituation* to dense letters must take place gradually. *Spatial attention* research suggests that weaker students may not focus attention on a letter shown or isolate it from other shapes on the blackboard, so children may be repeating verbally but not linking the shapes being taught with the sounds. In many classrooms, 2-3 children are asked to take turns to read a few words on the blackboard; the rest may memorize the order and may seem to be reading but they are just repeating from memory. Activities such as pointing to the blackboard or touching the large letter on the textbooks may help focus on the correct target.



- Teaching only one letter per reading hour. To facilitate automaticity, the smallest possible chunks could be taught at one time. Research shows that perimetric complexity is inversely related to probability of learning a shape, so teaching individual letters (synthetic phonics) takes less time to learn than entire words. It is useful to start teaching the most common letters of a language, so that many words can be made early on. It is not wise to show pictures and expect children to “read” the labels; many get cues and just say the word without knowing the letters.

-Enhancing the retention of sound-letter correspondences. Teachers are to point to the target letter and pronounce the sound with no verbiage in between in order to “impress” children with it. The sound is “bbbb.” Pronouncing the sound rather than name, omitting extraneous vowels is crucial. Children should repeat and touch the letter on their books to ensure that they are not mindlessly saying the sound. A large b on the board or a flash card will increase the probability all will connect sound and letter, particularly those sitting further away. In crowded classes

teacher could approach the back rows and direct questions to specific children rather than wait for volunteers.

<p>Some children repeat words without looking at the letters. Distance, letter size and density, teacher neglect contribute to this problem</p>	<p>Child pointing to blackboard and repeating without knowing how to read</p>
	

-Pattern detection and letter permutations. The mind seeks patterns and learns them fast, and children are expert pattern detectors. Teaching must include explicit instruction on the rules and change patterns related to various sounds and parts of speech. These include comparisons (ka ba za da la, also ak ab az ad al) and contrasts (such as *ka ki ku ke ko*). The first letter to teach may be a common exclamation (a!) and then the second must make permutations with the first: ab ba. Thus increasingly larger chunks will be formed.

-Initial use of invented words. To reduce reaction time to letters, students ought to read a page of text per day, not just a few words. To achieve this during the first few crucial lessons when few meaningful words are formed, invented words that conform to the rules of a language are offered: aba, bab, baab, abba. (Children must be told that these don't make sense.) After about 10 letters are taught, there should be no further need for invented words.

-Independent reading practice speeds up letter identification towards the eventual attainment of **automaticity**. At slow speeds people tend to read aloud and keep their finger under the text, but with automaticity silent reading is enabled. Children should read and reread texts multiple times. They should read until they instantly identify each letter and read fluently, effortlessly. Perhaps half the class time should be spent in this activity, which the better off students may do at home. Initially students make mistakes and may quickly stop reading, but teachers must keep focusing them on the task. If feasible, students should get **homework** to read at home every evening to stabilize memory before sleep and should read to their parents.

- Corrective feedback for all, even briefly. Feedback is essential for improving performance, but many teachers “broadcast” to the class and interact mainly with the better students. Students who lack home help often fail because they get little or no practice or feedback. Thus, brief systematic feedback is needed, with the teacher passing by each child and listening to them read for perhaps 5 seconds. Even with large classes this is feasible. After a few weeks, the better students can monitor the others. Also students who missed classes should be paired with others

who know or briefly taught to catch up. If carried out approximately as planned, this activity should leave no child behind.

Learning curves illustrate the power of practice

Pirolli and Anderson (1985)
Participants practicing sentences reduced reaction time from 1.4 secs to 0.7 sec in 25 days

For the first 100 days of an “emergency” course, writing may be emphasized less. Writing enhances memory of shapes, but is time-consuming task and take up valuable instructional time. Procedural memory research suggests that students may write more easily after they know the order of the letters to be written. A first week of introductory activities may include writing, story telling, and phonological awareness exercises. These oral exercises may help map letters to sounds, but studies have shown that teachers have difficulty doing this task, and studies are inconclusive about its added value in consistently spelled languages is unclear. By contrast tone awareness and exercises is very important, given the frequency of tonal languages in Africa.

Optimizing Teacher and Supervisor Training

Teachers of limited education may have difficulty retaining and subsequently executing multi-step methods with multiple options (cognitive overload). All these principles must be integrated into a daily routine consisting of small number of simple, sequential, easy to follow steps that can be comfortably carried out within an instructional hour. Research offers few suggestions on how many steps teachers of various ability levels can automatize. One potential proxy variable for this and perhaps for their ability to read teachers’ guides would be reading speed and performance in extracting a message and performing it. This may be a monitoring function, but it is also an important item for future research.

Gambia: independent reading, teacher passing by to reach with each child (2011)	Bangladesh: teacher listening to a child read for one minute per day (Gono Shahaja Shangstha NGO)

To execute effectively, teachers must be trained to monitor time and become attuned to intrinsic incentives that will increase the probability of executing the tasks when no supervisor is

watching. Teacher training topics would thus include the rationale for showing up on time, keeping all students occupied all of the time, attending to all rather than to the best few. Also, teachers being trained to teach in local languages must learn to read those, since they have probably not done this. A number of the teachers may know multiple languages, so knowing the vocabulary of each and the textbook contents would be important.

Lecturing and one-time demonstrations may not suffice to help them execute later and in an environment different from where training has been given (memory is encoded for time and space). To facilitate training of little-educated teachers, observational learning research can be applied. Teachers may watch multiple times brief edited videoclips of desirable behaviors and practice what they see, along with discussions of the rationale. The technology to create these and to play them even in areas that lack electricity is now fairly simple, but the process must be tried and fine-tuned for large-scale implementation.

The above challenges make it important to have a **body of supervisors or coaches** who would visit teachers on a regular basis. Training of **principals** is also important. Ideally, one supervisor should be appointed for every 12 or 15 teachers who will visit about once every two weeks. Supervisors are often teachers with years of experience, who may be taken out of classrooms where they teach effectively. The costs and logistics of steady visits are an important component of programming.

Scripted Lessons or Succinct Guides for Teachers

The idea of giving teachers scripted lessons to read has gained popularity. It may be indeed useful for higher grades and languages with more complex spelling, such as English or French. But there are concerns about utilization rates. One possible reason is volume; scripted lessons and guides are often written in dense print by people who read much faster than teachers.

For reasons of realism, a program would have to be prepared for large-scale implementation by untrained teachers. Teachers often move, and trained teachers are inevitably replaced by untrained ones. It may be desirable to include brief instructions to teachers in the textbooks, using a different color ink. The instructions may also be placed at the end of the book, in order not to confuse students. There may be teacher and student versions of the book, though that level of complexity may be excessive.

Designing Textbooks for Efficient Reading Instruction

New textbooks will be needed for this program, that in some ways resemble the syllabaries of 100 years ago. Where textbooks in local languages exist, an initial supplement of letter-by-letter instruction may have to be inserted before existing, more complex texts. An equally important aspect is textbook delivery to schools and on time. The challenges inherent in this task are well known, and measures must be taken to deal with them early on. Without textbooks, reading activities inevitably revert to writing limited texts on the blackboard that students quickly memorize and mindlessly recite without identifying letters or linking them with sounds.

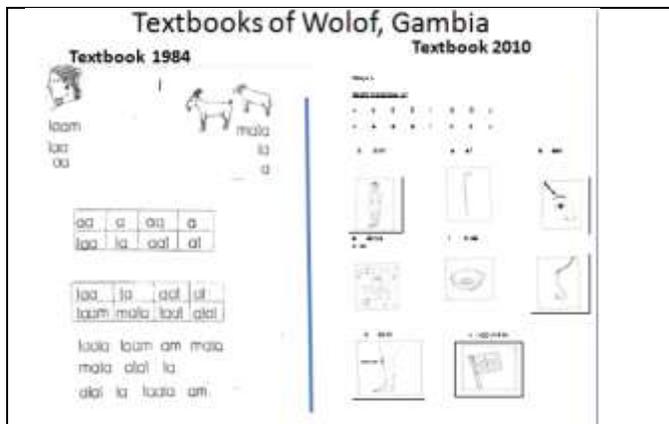
Cambodia – waiting for the bell: training needs for better instructional time use



Textbooks should present each letter and include systematic combinations. Every page in a beginning reader should maximize text amount. Visual perception studies suggest that in grades 1-2 letters should be at least 24 point fonts sans serif (such as the SIL Andika), lines should be double-spaced, with 3 spaces between letters. The utility of pictures before automaticity is dubious, so few pictures other than keywords would be needed. To maximize practice despite print scarcity, textbooks should have around 4000 words (about 150 pages, depending on format). Analogies and texts may best be written in linear sequence, so that teachers with limited or no training may follow the books page to page.

Books in consistently spelled languages are relatively easy to write, because any word can be written after the basic letter set has been taught (in the Roman or other scripts). Unlike the grade-level texts needed for English and French, vocabulary must be controlled only for familiarity. Since this is a simple occupation, teams of teachers can prepare such textbooks within a week. Local languages often have few materials, but many stories already exist that can be relatively quickly adapted.

Most frequent letters should be given first, and real or artificial words made only with those. The small letters should be taught separately from the capitals, all one by one.² Reviews should be set after about 4 letters. Because of visual crowding, shorter words are initially preferable, so in the case of, say, Bantu languages, it may be useful to put spaces initially between constituent segments.



Print size and density considered normal in 1982 and in 2010; beginning readers can read the earlier font more easily

Community sensitization. Sometimes the perception arises in communities that local languages are for the poor and formal languages are for the better off. Some parents may say “my child knows our language, I am sending him to school to learn English.” A local-language program ought to deal with those issues. There is a need to explain clearly the advantages of the local language instruction through social marketing or other similar efforts.

Multilingual societies often have more languages than can be practically used by governments. The issue thus arises how to

² Calligraphy, cursive script is popular in Africa; but it should be avoided until the visual word form area has been sufficiently activated, and students see the calligraphic letters as alternatives to the prototypes.

teach children whose mother tongue has not been selected for use in literacy. Even when a new language has to be learned, the benefits of spelling simplicity may outweigh the costs. In grade 1, children still learn languages easily through personal interaction (e.g. at the playground or in the market). Some research suggests that they may do better than studying in the formal language. Unless there are political issues, children may benefit from spelling simplicity if they become literate in a similar language or one that they know partially. “Social negotiation” has been used in countries such as Burkina Faso to engage communities and obtain agreement on the language of instruction where multiple options exist.

Assessment of Reading Outcomes

Reading achievement can be measured in terms of letter sounds correctly identified overall as well as in terms of letter-reading speed (random automatized letter naming). Words per minute in connected text would also be measured, along with comprehension questions. In the second half of the year writing and dictation could be included.

Monitoring the rate of implementation during instruction is very important. Supervisors ought to record the lesson number taught during visits to classes, note whether teachers carry out the expected behaviors, and spot check students’ knowledge.

One innovative measure to be introduced is reaction time to letters and words. With computer displays (programmed through matlab), the milliseconds needed for stimulus identification can be monitored from day to day. Thus the rate of progress towards automaticity can be documented. This would be an important research aspect of a reading program that would help fine-tune interventions.

Of course it would be highly desirable to conduct targeted research and evaluations in order to specify the model better. But children are dropping out as this document is being written, and time is of the essence. Hopefully research will be conducted as part of evaluations that will accompany interventions.

Literacy program results based on this instructional methodology

GPE has offered demand-driven technical advice to several countries; in two, Cambodia and the Gambia, pilots have been carried out. Results have been impressive in comparison to controls, and also to other methods.

-In *Cambodia*, a pilot application to 100 schools improved performance from one year to the next in all measures. For example, letters by minute rose by over 100% (30 to 63), words per minute by 63% (23 to 35 wpm), and comprehension by 70% (48% to 68%). After one year of trial, the method was scaled up to the entire country.

-In the *Gambia*, a pilot was applied to 125 schools, but only 50% of the lessons were implemented on average. Still, the percentage of first graders knowing at least 80% of the letters was 69% in the Pulaar language and 57% in Wolof (target was 85% of children). The pilot was expanded and may become national in another year.

- GPE also provided some technical advice to a USAID project in *Egypt* developed along the same principles. Within six months of application in grade 2, word and text reading fluency rates doubled in comparison to rates obtained two years earlier (from 7 to 15 and from 11 to 21 words per minute respectively; syllable reading tripled from 10 to 28 syllables per minute. By contrast, the same measures in control schools improved only by about 27%. The percentage of students reading 0 correct words was cut by half in project schools (from 44% to 21%) while in control schools it improved only by 10%. The program has been expanded widely in the country.

The above results were obtained after just one year of implementation. More intensive involvement and emphasis on critical variables should help not only attain the 85% target but also surpass it, despite systemic inefficiencies and scale-up difficulties. Early reading acquisition will put students on the road to comprehension and towards complex cognition which is currently rarely attainable. Thus, literacy will simultaneously fulfill equity goals.

Transfer Strategy to the Official Language for Multilingual Societies

It is important for the poor not to fall behind in official curricula while learning local languages. Keeping up with the curriculum is achievable by splitting the usual two-hour daily program of language arts into two: (a) reading in local languages as described above, and (b) oral instruction in the official language (English, French, Portuguese, standard Arabic as needed). Language instruction can be optimized through various methods (which are beyond the scope of this document). Most simply, teacher may use the contents of the grade 1 textbooks that typically exist in various countries. In that case, only the teacher needs the textbook.

In grades 2-3 after students have become fluent readers in local languages, they need an explicit bridging course on how to read in the official languages (assuming same script). Research shows that following this route, literacy in the spelling system of the official language will be greatly facilitated.

Remediation of non-readers: Literate school in 100 days

The above procedures can be used as a remediation tool for the illiterate students in grades 2-6. Older students in particular, have longer working memory and better executive control, and they would be able to do this program in less time than that needed by first graders. In principle, students would become fluent in a local language, then receive a bridging course to read in the official language, and then be reinserted in their respective grades to gain more practice by reading their grade-level textbooks. It is assumed that illiterate students of advanced classes have some knowledge of the official language, but this assumption must be tested.

If school-level logistics permitted teaching illiterates in two waves per year, entire schools could become free of illiteracy in 2-3 years. By upscaling the program, entire countries could thus perform.

Ability to scale up the program depends on a tight causal chain and effectiveness. First of all, the steps must be optimized so that in small controlled pilots success is nearly 100%. Generalization of any pilot has administrative and other challenges, which inevitably reduce efficiency. The hope is even after the introduction of systemic inefficiencies, a tight causal chain will enable 80% of the students to become literate. A close followup during pilots is needed.

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