How to Speed Up Arabic Literacy for Lower-Income Students?

Some Insights from Cognitive Neuroscience

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Background

Students in low-income countries often have trouble learning to read; 80-90 percent of second and third graders in some countries cannot even read a single word and may know few if any letters (RTI 2009, 2010, 2011a, 2011b). The reasons are linked to limited instructional time, textbooks or parental help, potentially poor nutrition, or complex teaching methods that originated in high-income countries (e.g. Abadzi 2006, RTI 2009b).

Despite relative affluence, the academic performance in the Arab world has been a problem, with countries scoring on international tests much lower than expected based on per capita income level. Similarly Early Grade Reading Assessments (EGRA) in various countries have shown lower reading speeds than one would expect. In Pakistan and Afghanistan, which use the Arabic script, the issues are similar.

<table>
<thead>
<tr>
<th>Stacked letters in early grade textbooks are often not taught explicitly</th>
<th>Mosque lamp, nonlinear writing</th>
</tr>
</thead>
<tbody>
<tr>
<td>مَرَيْمُ وَلَيْ صَبَاحٌ أُخْبِرُ الْمُهْدُوْرُ</td>
<td>Museum of Islamic Art, Qatar</td>
</tr>
<tr>
<td>أُورُ يُبَار وَكِيْا</td>
<td></td>
</tr>
</tbody>
</table>

Urdu grade 1 text in the last line

The languages and scripts of the world conform to the information processing capacities of humans, so they have substantial underlying similarities. Nevertheless, different scripts pose different challenges for beginning students and require different amounts of time to attain fluency. For example the syllabic scripts of south and East Asia consist of regularly occurring patterns that are large in number and visually complex. European languages are written using 24-30 Latin, Greek or Cyrillic letters that arose from the ancient Phoenician script. Some of them are written as pronounced (including most African languages) and most students may attain automaticity in 3-4 months. Others reflect pronunciations of bygone centuries, requiring extra time for students to automatize spellings; English takes 2.5 times longer than German (Ziegler and Goswami 2005). Chinese partly relies on morphology, and learning enough to read common material requires around four years.

Among the various scripts, Arabic stands out due to some unique characteristics:
- It is consistent and to read when vowels are marked; when they are not, students must predict words from morphology;
- Individual letters are relatively simple shapes and should be simple to automatize;
- Vowels é and ó cannot be written, so the languages that need them use approximations; (e.g. Urdu, Farsi, Pashto)
- Letters have obligatory connection rules, and letter boundaries are often unclear; also boundaries of words are sometimes unclear;
- Many letters consist of two parts (e.g. cups and dots) which students must learn to expect, often at some distance above or below the letter; it may unclear shape the dots belong to
- The layout of the letters is not necessarily linear; certain letters are habitually stacked above or below others, creating new shapes that must be learned;
- About 4 letters are taller than the others, forcing the rest often into very small fonts.
- About 4 letters of the standard Arabic are pronounced differently in dialects.

According to perceptual learning studies (Pelli et al. 2006, 2003), some features of the Arabic script create visual crowding and a perceptual bottleneck that may affect even proficient readers. Our visual system optimally discriminates when letters have certain space between them. People exposed to letters quickly adapt to crowding, and exposure to print has increased in recent years, enabling the use of small fonts. The difference can be readily seen when comparing older and contemporary textbooks. (See for example a comparison between contemporary Urdu text and 1925 Ottoman Turkish texts,) However low-income students who get less exposure to print may have trouble reading texts made for middle class students and can benefit from broadly spaced text. Spacing and the use of explicit phonics make old textbooks paradoxically more suitable for less knowledgeable readers.

| Grade 1 Urdu textbook (author unknown), around 2000. | Ottoman Textbook 1925 (author Ali Heydar) |

Language issues – Arabic Diglossia

Vowels are predictable in Semitic languages, so if the readers know the language sufficiently they can be deleted. In the Indoeuropean Urdu, Farsi, Pashto, Dari and other languages that use this script (including traditional use of some Indonesian and African languages) predicting

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2 Hebrew also deletes vowels, but its letters are separate and linear, thus avoiding the Arabic visual complexity.
vowels is hard, and students must just memorize the unvowed forms. Texts of these languages use spoken forms, so if Pakistani or Afghan students decode the text, they can make sense of it.

However in Arabic, the language is to a large extent unfamiliar. The Arabic world writes almost exclusively in the modern standard Arabic (fuscha) which no one really speaks at home. Studies show that the classical and dialectical Arabic share only about 40% of the vocabulary, and only about 20% of the words have the same meaning in the two versions. Differences exist in common features, such as conjugations and negative formation. Language problems pose additional difficulties and may magnify the perceptual effects. For example, students reading unvoweded Arabic must predict verb endings that they do not habitually use.

The interaction of the perceptual and linguistic complexities turns Arabic reading into a complex multistage exercise. A reader of the Arabic script must (a) decipher the text, (b) predict the vowels and keep multiple alternative words in working memory to test and decide on meaning, and (c) make linguistic sense in the case of Arabic. This process means that readers need to identify words faster than in other scripts in order to make sense of the text, but in fact they identify them more slowly. Not surprisingly, some studies suggest that the Arabic script may be read more slowly than visually simpler scripts or linear scripts.

As a result of these changes, some students may see the vowels deleted just as they are beginning to read automatically. This then may reduce reading speed and further delay comprehension further and result in poor test scores. Considerable cognitive load is needed to identify likely alternatives for the unvoweded word shapes, hold them in working memory, and then make sense of sentences written with a grammar and vocabulary that may be partly understood. This difficulty may be one reason why many literate people in the Arab world reportedly spend relatively little time in reading activities.

Some of these issues have been rarely studied and are poorly understood. Curricular designers tend to be middle-class native readers; they have been programmed and become habituated to the exigencies of their script and may be unaware of the perceptual difficulties faced by poor children that get no help at home. The grade 1 textbooks of most Arab countries (e.g., Egyptian, Yemeni, Moroccan, and Tunisian) introduce whole words and standard Arabic from the first day, without making explicit efforts to teach the knowledge students lack. If parents are available to teach children at home problems may be overcome, but the poor may not have this facility. Thus one often hears that students need 3-4 years to learn how to read in Arabic.

Those who cannot do this complex work on day 1 may fall behind and deal with texts inefficiently. If all the attention must be spent in deciphering texts, there is little left to actually attend to information. Thus the early grade obstacles constitute a serious reason why Arab students score low in the higher grades.

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3 Reading is essentially a race to throw text into working memory before it is wiped out. When people read slowly they understand less. Milliseconds lost in deciphering letters add up, and they mean that less text is available in working memory. Memory has serial position effects, so students reading slowly tend to remember the beginning and the end of a message, thus missing the main point.
The standard Arabic vocabulary and grammar may be taught explicitly in the various Arab countries through scripted lessons and direct instruction methods such as used in the US. Depending on dialectical differences, different countries may explicitly teach the grammatical constructions that are dissimilar to local script and also teach the needed vocabulary.

How to increase the efficiency of reading instruction in the Arabic script?

In many respects early-grade reading consists of low-level neuropsychological functions, which must be tuned to enable recognition of certain shapes in milliseconds and instant connection to sounds. Then a message can fit within the capacity of working memory and if the vocabulary is known, it can be understood. (See Abadzi and Prouty 2012 for a detailed explanation).

People learn larger chunks of material only by automatizing small chunks. Those who fail to learn the sound-letter combinations or small letter units cannot go on to texts of greater complexity. They can neither catch up on their own nor learn more advanced material by skipping the elementary gaps. Thus the first few days matter a great deal.

Education for All implies that nearly all students must somehow learn fluent reading very quickly when they start school in order to then progress to higher level topics. This must be achievable in all the languages and scripts used in low-income countries. By focusing on these lower-level variables this is doable.

Because of information processing commonalities in people, the same general learning principles facilitate reading acquisition for all scripts. These include:
- showing students how books are used (“concepts of print”)
- writing large and broadly spaced characters,
- ensuring that students actually focus on the requisite letters
- teaching students to break down words into sounds in order to map them to letters
- teaching the smallest pronounceable chunks one at a time,
- exposing students to pattern analogies,
- using textbooks developed on the relevant principles
- giving reading and writing practice that will reduce reaction time and induce automaticity.
- providing corrective feedback
- teaching the vocabulary needed to understand text

Phonics have been taught in Arabic for centuries, (method called tariqa Bagdadia (طريقة بغدادية) or tariqa hija’ia. (طريقة هجاية)). The methods in the Arab world have changed to whole word and whole language as a tendency for “modernization” and desire for direct reading of unvoweled Arabic. However, such complex demands on young children work best for the children who are very intelligent or who are better off.

Much efficiency will be gained if the old phonics principles were used and improved. In grade 1, Arabic ought to be taught almost as if it were Spanish. The goal should be to get all students to identify the letters in milliseconds. This ought to be possible in about 60 lessons; considering absenteeism and the need for reviews, the fundamental literacy for voweled Arabic could last about 100 days. Some of the components of improved phonics methods would include:

How Books are Read: Need for Concepts of Print

The majority of students in the Arab world are likely to have seen books before attending school, but the poor everywhere in the world have limited exposure. To ensure everyone knows, students should be shown during the first week of school that books contain symbols written in certain directions. Students can be asked to point to the beginning and end of a page, show the direction of reading, and understand that they must go from one line to the next.

Phonological Awareness

Much research has linked phonological awareness to reading achievement, so students must understand early how to map letters onto sounds. Exercises are oral and ought to be taught even before actual reading, at least during the first two weeks of instruction. These would include marking the beginning sound, breaking words down into phonemes, identifying syllables (e.g, Durgunoglu and Oney 1999). Teachers often find it hard to do these exercises, so some planning is needed.

For unvoweled reading, morphological awareness will be important and is beneficial in all languages (Deacon et al. 2010). For example students must predict which words start with a ma, mu or end with pronouns.

As a result of these methods some Arab students are taught to say “d+fatha = da”. This is useful and teaches them the basic technique. But they should soon be taught to say “d+a = da” rather than ‘fatha’
Teaching Phonics –Smallest Possible Units in a Script

In the Arab world, textbooks overwhelmingly teach reading through whole words. For multiple reasons, whole language and whole word approaches are not very efficient in lower-income environments; to the contrary, much research as well as the understand of how information is processed dictate that phonics must be used.

In Arabic this means teaching letters in the beginning, middle and final position, along with the short and long vowel signs (fatha, dhamma, qasra, also shidda). These need to be introduced gradually, probably no more than one letter or sign per day. The more frequent letters can be taught first, so that meaningful combinations can be made soon.

To focus children on letters being taught and clarify their sound, they should be presented using as few words as possible to focus attention on the sound-shape linkage. Such techniques may increase opportunities for long-term potentiation, the neural-level process which enables stimuli to be linked permanently in memory (e.g. Arai et al. 2009). Emotional expressions may help retain letter shapes (Nielson et al. 2006, Wagner Cook et al. 2009).

In general, how to teach phonics gradually? If the first letter is a! the second can be one that produces common combinations with the first (e.g., if it is b, then students can decode ab bab, ba, aba, baba). The beginning permutations may not be meaningful, but they are needed to teach patterns and reduce reaction time. The use of legal nonwords improves decoding skills (Cárdenas 2009). Students may instantly look for word matches, so they must be warned that syllables and words may not make sense.5 After about 10 commonly used letter sounds are taught, the permutations ought to result in real words.

USAID has developed a phonics-based method for Arabic, which is called the Girls’ Improved Learning Outcomes (GILO). It consists of explicit, letter by letter instruction along with various targeted activities. The materials were developed with considerable piloting and attention to detail. They contain materials, training videos, and scripted lessons for teachers. The suggested exercises are a bit complex and demand materials that may be more available in the higher income countries. Also the letters have rather small size sizes and the fonts are a bit calligraphic.

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Egypt: Girls' Improved Learning Outcomes (GILO)

a three-year USAID-funded project aiming to increase the educational enrollment and achievement of girls
144 schools, Much teacher training and supervision

**Goal: Reading at Desired Level:**

- **Letter Names and Sounds:** 27+ Correct Letters Read in 1 Minute
- **Words and Non-Words:** 25+ Correct Words Read in 1 Minute
- **Passage Reading:** 45+ Correct Words Read in One 1 Minute

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5 Skilled adults get specialized responses to words within 250-200msec of exposure and arrive at the meaning within 500 msecs from the time they start reading a word (Alison et al. 2002, Grainger and Holcomb 2009; Gabrielli et al. 2010).
With thoughtful simplification, this work constitutes a basis for further work. Students can be taught without cards, merely with a textbook and notebooks. The teachers could draw big letters on the blackboard instead of using the flipchart (which may be too small and low for students at the back). A black and white textbook can contain the reading exercises and activities instead of worksheets and blackboard expectations.

<table>
<thead>
<tr>
<th>EGRA Test Component</th>
<th>Change in Mean Score</th>
<th>% of Grade 2 Students Reading at Desired Level *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter Names</td>
<td>+ 34%</td>
<td>78% (+17%)</td>
</tr>
<tr>
<td>Letter Sounds</td>
<td>+ 192%</td>
<td>51% (+3%)</td>
</tr>
<tr>
<td>Words</td>
<td>+ 111%</td>
<td>24% (+13%)</td>
</tr>
<tr>
<td>Non-words</td>
<td>+ 61%</td>
<td>12% (+6%)</td>
</tr>
<tr>
<td>Passage Reading</td>
<td>+ 91%</td>
<td>20% (+13%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EGRA Measures</th>
<th>Mean Scores, INTERVENTION Schools</th>
<th>Mean Scores, CONTROL Schools</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syllable Reading</td>
<td>9.96</td>
<td>20.47</td>
<td>+ 102%</td>
</tr>
<tr>
<td>Word Reading</td>
<td>7.35</td>
<td>15.50</td>
<td>+ 111%</td>
</tr>
<tr>
<td>Oral Reading Fluency</td>
<td>11.09</td>
<td>21.14</td>
<td>+ 91%</td>
</tr>
</tbody>
</table>

**Maintaining Student Attention during Letter Presentations**

Visitors in lower-grade classes often observe students repeating in a chorus text written on the blackboard without actually reading. Text may be undecipherable from the back seats, or they may be looking away. Their voices may assuage teachers, but most students may be in fact illiterate.
To prevent mindless repetition of sounds, techniques must be used to attract and maintain attention to a letter being taught. Children may be asked to put their thumbs up if they understood and down if they did not. They may be asked to point to a flash card while voicing the sound and to put their fingers on the letter on the book. (So the presentation letters should be big.) They could also be asked to come to the front of the class to see new letters from close up.

Spatial attention may be a developmental feature, and poorer children may perform it less well. This is a crucial problem that must be resolved through, and some experimentation may be needed.

**Pattern Analogies**

To learn fluent reading and rapid recognition of patterns, students may benefit a lot from learning a table of orderly combinations. Students are excellent pattern detectors, and these need to be shown. Analogies have been discussed as above. They include the use of vowel signs and the patterns in beginning, medial and final shapes of various letters.

<table>
<thead>
<tr>
<th>Vowel consonant analogies can be used in Arabic</th>
<th>Pattern analogies in Ottoman Turkish – 1925</th>
</tr>
</thead>
<tbody>
<tr>
<td>a    e    i    o    u</td>
<td>+</td>
</tr>
<tr>
<td>B  ta  be  bi  bo  ba</td>
<td>ت</td>
</tr>
<tr>
<td>C  ca  ce  ci  co  ca</td>
<td>ك</td>
</tr>
<tr>
<td>D  da  de  do  da</td>
<td>د</td>
</tr>
<tr>
<td>F  fa  fe  fi  fo  fa</td>
<td>ف</td>
</tr>
<tr>
<td>G  ga  ge  gi  go  ga</td>
<td>غ</td>
</tr>
<tr>
<td>H  ha  he  hi  ho  ha</td>
<td>ح</td>
</tr>
<tr>
<td>Etc</td>
<td>دئ</td>
</tr>
</tbody>
</table>

**Writing Encodes Letter Memory into Movements**

Movements help consolidate the memory of associated information (Dijkstra et al. 2009) so extensive writing practice would help establish the automaticity and speed children will need later to express concepts on paper quickly, before they forget them. Students will remember the letter shapes and sounds much better if they write them down many times. Paper or slates ought
to be used because it leaves feedback behind for the students and teachers. Teachers need to dictate letters, syllables, and words for students to write.

Copying practice increases writing speed and has some utility. However, children may copy a lot of text without knowing letter values, as if it were art; so mere observation that they can copy does not constitute evidence that they can read.

Movements to create mnemonics of the letters or drawing them in the air may consolidate memory more efficiently than merely seeing them or writing them. (No studies have been found but this activity makes sense from a neurocognitive point of view.

**Practice to speed up reaction time**

Students should read aloud or silently until they read fluently and effortlessly. They can read texts all together, alone, in small pairs, reread the same text after some time, take books home to read to parents. Because they easily learn sequences of words by heart, they should get a *lot of different reading exercises*, not just a few sentences as is commonly done. Individual practice should be a part of the daily routine.

What about comprehension? This is the ultimate goal of reading, but happens only after the early obstacles are overcome. Literal comprehension is a normal human function if the vocabulary is known. In consistently spelled languages, students ought to make sense of simple text and render its meaning without further instruction (Georgiou et al. 2008, 2009). Exceptions may be students who have unusually limited working memory (Gathercole and Alloway 2008).

Working memory has serial position effects, that is the beginning and the end are recalled more easily (Gupta et al. 2005). When students read relatively slowly and close to working memory limits, they tend to miss the content in the middle. Thus when slow readers retell content, the results may be inaccurate (Cohen et al. 2009). Paradoxically it helps weak readers to re-read text slowly and carefully in order to understand it better.

The term “comprehension” often includes predictions and inferences. These indeed can be taught and are beneficial. But strictly speaking they are higher-order functions that do not stand in the way of literal comprehension. In low-income schools where instructional time is limited, valuable reading fluency may be sacrificed to practice these functions early on.

**The Importance of Brief Corrective Feedback to All Students Daily**

Classroom observations often show that few students are involved in instruction at any given time (e.g. IEG 2008, 2009a, 2009b, 2009c, Schuh More et al. 2009). Teachers in low-income environments often stand by the blackboard, address students at large, call for volunteers, and
interact mainly with the few who know the answers. Corrective feedback is crucial because the nervous system must determine whether an action is correct (Salamone and Correa 2002, Galvan et al. 2006). The better students may gradually concentrate at the front, while weaker students may sit silently in the back. Children that escape teachers’ attention may never learn to read (Lockheed and Harris 2005, Llambiri 2005).

Teachers in high-income countries are expected to give individual attention to students’ learning needs. But this is usually impossible in countries with a long tradition of selectively attending to the best. However, some experiences, notably from the Bangladeshi NGO Gono Shahajjo Shangstha⁶ suggest that it may be possible to systematize the checking of all students’ knowledge and offering of brief corrective feedback. The teacher could hear each child read three or four lines for a few seconds per day during a time others are practicing. Teachers could be taught to do this systematically row by row starting from the back. The three or four best students could also be identified and set to work with the weaker kids at the same time.

Teachers need to be trained specifically for these activities, and they also need to understand why they matter. One important aspect is to discuss the “for all” aspect of teaching to read. Often the weakest children are the ones most likely to give up, stopping work after reading a few words. There is a need for monitoring that teachers are not used to giving to the weakest. In fact, consultations with them and videos may be important in increasing attention to this critical issue.

Removing vowels in the Arabic Script

After reading is automatized, a visual dictionary is made of words, and their meaning becomes evident without resorting to sound (Glezer, Jiang, and Riesenhuber 2011). Eventually Arab students must learn to read without vowels. When this happens, new visual patterns result and must be automatized all over again. Unvoweded patterns have fewer features and could potentially be more efficient to read. One brain imaging study of adult readers found that reading words without diacritics yielded shorter response times than words with diacritics (Burisly et al. 2013).

When vowels are deleted, however, students must retain too many alternatives in working memory, thus needing high prior speed. Alternatives in working memory compete with the meaning of the passage. So as texts become more complex, the working memory load gets an

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⁶ www.gssbangladesh.org
extra burden. This, combined with linguistic issues may be reducing the amount of content that students retain.\(^7\)

For unvoweled Arabic, sight words could be of considerable help. Example is a Lebanese list of frequent words (Oweini and Hazoury 2010). Other countries can adapt it as needed. For Urdu, Farsi, Pashto similar words lists should be developed if they do not already exist.

To get students to decipher text, retain its meaning, and perform in exams, it makes more sense to keep the vowels through primary and attempt gradual deletion. (They could become dimmer, though, i.e. gray.)

Due to working memory limitations, speed is required for comprehension. Perhaps a threshold speed is needed to hold alternatives in mind and thus safely remove the vowels, but we have no sense at this point what it is. Data may exist in various studies of the Arab world, and a literature review may find them and obtain insights.

**Scope, Sequence, and Curricular Time**

The implications of the above research can be operationalized in a basic reading course. It would be taught or one hour a day during 3-4 months (about 100 days). It would be pitched at lower-scoring students, first graders or older children who have remained illiterate. By the end of 100 days in various languages and scripts (excluding English, French, Chinese, or Khmer), some students should be barely decoding while others could be reading 100 wpm. But there should be no student reading 0 letters or 0 words per minute.

Voweled Arabic is no exception. Despite the perceptual learning and linguistic problems, the voweled version is very transparent. With consistent instruction, basic literacy should take 3-4 months, at most a year. So it should conform to the timeframe of the transparent European orthographies (Seymour et al. 2003). Some USAID documents state 3-4 years, but this timeframe pertains to English.

Due to the various challenges, reading instruction ought to be taught in a separate curricular time, one instructional hour per day in grade 1 (and in subsequent grades for recuperation). The instruction should not be mixed up with language instruction. To the contrary, in Arabic language issues should be minimized at that first stage in order to ensure that students learn the letters and acquire automaticity. Reading and language can merge, after the first semester, if nearly all students learn at least the letter values. The mixing of the two is probably one reason why students in countries like Yemen may take 3 years to learn reading.

By the end of grade 1, students taught explicit phonics, e.g. through simplified GILO project materials, and should be expected to perform reasonably in EGRA, even if they don't understand well.

\(^7\) Bourisly et al. (2013) found stronger activation in the hippocampus and middle temporal gyrus, possibly reflecting a search among multiple lexical entries that may be associated with these words. In contrast, real words with diacritics yielded longer response times and activated the insula and inferior frontal areas, suggesting an engagement of phonological and semantic processes in recognizing words with diacritics.
A parsimonious instructional routine for the Arabic Script

A basic reading course would have a specific time in the curriculum and not be mixed with language arts. It would focus on splitting words to the smallest readable phonemes, blowing up the print so that it is easily distinguishable early on, and getting enough practice for speed to build up and comprehension to take place. The GILO method could benefit from including the features that are not included.

If the course is implemented as expected (and this is always uncertain), the weaker students would be able to barely decode by the end of the first module, while the better off students would be reading fluently. Variance among students is inevitable as are subsequent inequalities, but it is hoped that detailed instruction early on will provide basic decoding for all. In principle, no child should be left behind reading 0 words per minute.

Thus, a daily routine would have the following features:

- **Concepts of print** for the first week of classes, mainly in low-income environments

- **Phonological awareness exercises** for the first month, notably on segmenting words into letters or syllables; morphology exercises;

- **Synthetic phonics instruction** with only one new letter taught per day at most; the most common letters would be taught first, with revisions every five days to accommodate absent students; writing on various media to consolidate memory of movements;

- **Directing student attention** to the letter being taught with few words, using pointing gestures that students will learn as a routine.

- Systematic instruction in **patterns and analogies** of letter combinations, with consonants in their initial, middle, and final positions; students may be forming the vowels with their fingers in the air.

- **Use of the vocabulary that is shared** between standard Arabic and local dialects, avoidance of unknown grammatical forms if possible.

- **Textbooks optimized for extensive reading practice**; attention to letter size and spacing, with small and relatively few pictures.

- **Writing** the letters and combinations being learned; teacher should dictate them.

- **Practice** to speed up reaction time to letters and words; lots of it, independently.

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8 Some educators advocate starting literacy by writing one's name. This ought to be a significant activity after most letters have been taught. On day 1 in Arabic, besides the difficulties of getting every parent to do this, the names may be written with stacked letters and unvoweled. So the children may not see the relationship between their name letters and those of the book.
- Brief corrective feedback for all students (even for 15-30 seconds per day), partly through help by the better students;

- Scripted lessons for teachers; training at least partly through observational learning, visualization, and detailed planning for critical behavior sequences;

- Frequent and specific supervision, partly by school directors who would also be trained through audio visually based techniques;

- Division of the school year into two or three modules to help teachers maintain proximal goals and enhance the probability of continuing performance.

- Results monitored relatively through quick, inexpensive one-minute reading fluency tests.

Clearly piloting is needed of these and other alternatives, particularly for the lower-income students of the Arabic script. However, decisions must be made quickly, and piloting or research must take place as interventions progress.

Textbook Design for Practice and Fast Attainment of Automaticity

To attain automaticity, students need many pages of legible text to practice. Students in the U.S. who score at the 98th percentile may read 4.7 million words per year, or 67 minutes per day, while those scoring in the 10th percentile may read 51,000 words per year or 1 minute a day (Anderson et al. 1988). Therefore, each student ought to receive a book to take home for practice and homework. The book should have a fair amount of material, i.e. 4000 words and relatively few pictures. (Look and say does not necessarily facilitate decoding.) During class, the students need to get time to practice reading, even if they are reading letter by letter in the beginning.

The visual issues in early-grade textbooks are important. The letters should conform to the critical space and critical size expectations. The fonts used in school books are often small and connected. It would be worth piloting the readability of mono-space fonts that have become very common in the Arab world.

Using Observational Learning Paradigms for Teacher Training

As mentioned earlier, teachers in low-income countries may get little or no training on how to teach reading. They would have to be trained on a large scale for reading. But in low-income
countries, pre-service and in-service teacher training efforts have produced limited results and limited behavioral changes (e.g. UNESCO 1998). Poor outcomes are partly due to brief training duration, limited prior education, lack of textbooks for student teachers, poor time use in training classrooms, and curricula that offer little actual guidance on how to teach.

Trainees may receive instructions to execute various procedures when they return to their class, but observations suggest that they may not do so. Perhaps the need to recall and carry out multiple tasks at the same time fills their working memory beyond capacity and result in "cognitive overload" (Feldon 2007). Those teachers with more limited education and fewer automatized skills may be more vulnerable to this phenomenon. They must become able to carry out the requested procedures automatically. One mechanism is observational learning.

People are biologically set up to model actions of people who have the same goal, so instructional behaviors may be more effectively taught through audiovisual role modeling and visualization (forward self-review; Dowrick 2010). These methods have rarely been used in low-resource environments, and they are more complex to create than mere lectures. However, the cost of technology has dropped significantly in the past years. Camcorders are prevalent everywhere through cell phones, and editing software is in every computer. Palm-top projectors running on batteries can be taken to areas that have no electricity.

Initial trials with brief instructional video clips were conducted informally in Liberia and the Gambia in 2011, and more detailed plans were underway to pilot this methodology in 2012.

Brief visually based training would cover the issues presented in the earlier sections of this article. Teachers would be shown how to interact with students in the back rows, how to listen to each child read a few lines, how to deal with absent students systematically, how to write with large and clear letters on the blackboard. They can learn to carry out fluently a consistent schedule of daily routines, which helps students anticipate the next activity (Stronge 2009). Audio visually based training could also be used for school principals and supervisors, who often fail to supervise. Establishing a few critical variables for supervising teachers and demonstrating those on video would help them detect patterns of more and less effective teaching and actually make this work interesting.

Teachers are typically expected to develop their own lesson plans, but even when these are done, they may be rarely carried out. To increase the probability that teachers will carry out the expected activities it may be advisable to plan centrally and prepare a series of “scripted” lessons. These have been a feature of Direct Instruction for decades in the U.S. and elsewhere (Adams and Engelmann 1996). Teachers can read instructions to students rather than try to reconstruct them. Practicing with the students may also teach teachers content and methodology.

**Measurement of Reading Performance**

Testing would include timed reading of letters and a simple 60-word passage along with five “shallow”, fact-based comprehension questions (Research Triangle Institute 2009, 2010). The learning outcomes would be measured in terms of letters per minute and words per minute read correctly. To In the first few weeks, reading speeds may be lower than those needed to understand passages well, but the most important early goal would be to leave no child unable to decode. In reality 100% of students cannot achieve reading; some may be severely dyslexic or
learning-disabled. In low-income countries using the Arabic script it may be wiser to set an initial goal of 83% of students decoding (down to -1 standard deviation of a theoretical normal curve of ability), extending to 96% (-2 SD below the mean). Thus there should be practically no students reading at 0 words per minute.

How to count words for maximal comparability with other countries? Arabic attaches the article to the nouns and also attaches the personal pronouns. An analysis must be done, but Arabic words per minute may count fewer words and is thus lower than the scores obtained in other countries. Some consideration is needed on how to count Arabic words. The articles could be counted separately, since most of the languages do so. However, agreements must be made regarding other languages.

**Conclusions and Implications for Further Research**

Learning to read in low-income schools is a bit like winning a lottery. Some students will manage, and often it is unknown in advance who will be the lucky winners. All methods teach some proportion of the students, but the more complex the method, the smaller that proportion will be.

Yet it is possible to make nearly every student win the lottery. Scientific research implies that some fundamental prerequisites must be satisfied before students enter the world of meaning, reading for fun, and “reading to learn.” Students must first be able to distinguish letters, detect their salient features, associate specific shapes to sounds. Then they should decode letter groups fast enough to fit messages into working memory. And they must have in their cognitive networks the needed prior knowledge to understand the vocabulary, grammar, and context of the messages. Most important, they need independent practice and corrective feedback to increase reading speed, and space in class must be made for this.

The multiple challenges of Arabic suggest a need for considerable extra research. To some extent it ought to be carried out with instruments rather than merely paper and pencil. These may include psychophysics measures through computers and neuroimaging methods, such as fMRIs, event-related potentials, eye-trackers, and other such equipment. These could provide information on how the brain perceives Arabic among beginning and proficient adult readers in the Arabic language and/or script. Such research requires expertise and funding that are beyond the purview of the World Bank. Furthermore many Arab countries have limited capacity for such research, though universities in OECD countries may carry it out.

The issues mentioned in this paper raise two sets of questions to which answers are sought. These roughly pertain to (a) perceptual learning aspects; and (b) linguistic aspects of Arabic. Briefly these include:

**(a) Perceptual learning issues**

- What is the method, presentation order of letters that will make the vast majority of lower-income students fluent readers in voweled Arabic? What are the outcomes of using pattern recognition and whole language approach vs. the more “traditional” phonics (tariqa hijayia)

- What are the most important difficulties affecting instant letter recognition among the early grades and the adult learners? Which adjustments can improve these?
- What is the optimal size, spacing, letter ratio that will speed up reading among children (and also illiterate adults)?

- What are the effects of tashkeel (vowel set) on automaticity? How do beginning vs. expert readers see voweled and unvoweled words? How does tashkeel affect speed?

- How can transition to unvoweled words be facilitated and at which grade(s) will this be optimal? Are there gradual stages for doing so? (i.e. putting a vowel only on the first syllable)

- Unvoweled Arabic requires some minimum speed. It is likely that a threshold speed is needed to hold alternatives and thus safely remove the vowels, but we have no sense at this point what it is. What should be the minimum speed to attain in simple text for unvoweled standard Arabic?

- The Arab world has high adult illiteracy, particularly among women. How can automaticity be facilitated for adults?

(b) **Linguistic issues**

- How well do students understand the standard Arabic in grades K, 1, 2?

- Which grammatical and syntactical features are similar and different between standard Arabic and dialects of each country? (e.g. conjugations, pronouns, popular use of verbs and nouns). How can the similarities and differences be used to speed up decoding and comprehension?

- Are there experiences in explicit instruction of the standard language? Would a direct instruction scripted approach improve outcomes for children whose environments minimize exposure in fuscha?

- How do perceptual learning complexities interact with comprehension difficulties at various stages of primary (and possibly secondary) school?

- Exactly how do diglossia effects interact with the removal of harakat (tashkeel)? Which harakat could be safely removed in various grades (e.g. the first vowel could be left with the intermediate ones removed)

- Given the limited overlap between standard Arabic and local dialects, there is a need for students to acquire the standard language vocabulary. How many words do they learn every year? What vocabulary or syntactical difficulties do they have in later years that may prevent the rapid comprehension of complex text?

- How fast do students read in various grades and how well do they understand? That is, how do reading speed and comprehension evolve in the higher primary and secondary grades?

- How should words per minute be counted in Arabic to achieve rough comparability with other languages?

- What trends are there for supplementary books to be read by students? Are there dictionaries for local dialects that could be used to facilitate transition?

Answers to the above questions ought to help provide policy advice to all countries that speak Arabic or write using the Arabic script. The author of this note has been monitoring for years the research on cognitive neuroscience, particularly for reading and for various scripts. Also searches were made on Arabic reading in databases such as ERIC. Thus far the searches have uncovered limited research on Arabic reading from English-speaking sources.
For this reason there is a need to search for evidence-based advice through a thorough review of studies, theses, dissertations that have been conducted in various parts of the world, including leading Arab universities. Such studies may have been produced through departments of curricula, special education, or related areas. Even studies that do not give precise answers may facilitate the formation of hypotheses and causal chains that may be tested later in pilot reading interventions. On that basis it may be possible to develop parsimonious programs, that can do more with less and give value for money.

**Potential methodology for a literature review**

A systematic and comprehensive literature review on Arabic reading and literacy acquisition could be carried out and synthesized with a special focus on early grade reading. The review would attempt to answer the questions posed in the earlier sections. It would involve: (a) a research on computerized databases in English, French, or Arabic and (b) personal contacts with researchers of leading universities in the Arab world to identify existing and/or ongoing research, such as articles and unpublished dissertations written in Arabic. The review would primarily focus on the Arabic language, but secondarily it would also examine documents discussing Urdu, Farsi, and Pashto (to clarify potential perceptual learning issues).

Computerized databases include ERIC, Google Scholar, LexisNexis, UN databases, and Universities Dissertation Databases, also French-language databases. The key topics to search would be: Arabic reading, Arabic Literacy, Arabic instruction, Arabic script, visual perceptual studies involving the Arabic script, Arabic language instruction methodologies, Arabic sight words, and Arabic graded materials.²

What is already known points to a need for iterative piloting and research. Technology interventions for reading are possible in the Arab world, and these would need to be piloted specifically. Brain imaging is providing insights about the parts of the brain activated for various tasks. This information can then put to use in likely methods that can be piloted. Results of course must be monitored, and further iterations would be made.

Overall, there is much potential for substantial improvement in reading achievements if attention is given to the low-level visual and linguistic issues.

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² A preliminary search of the ERIC database under descriptors of 'Arabic reading' located 290 articles and abstracts, 160 of which were quickly perused (from 2011-1970s; the Joint Library can obtain the entire articles.) The truly relevant articles were rather limited in number but do offer some insights on instructional methods and results, also some diglossia issues. Practically no reading studies were found on Urdu, Farsi, Pashto.
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