



EXECUTIVE SUMMARY

Overall, Arab countries score lower in international assessments than non-Arab countries. The gap may be partly due to the visual complexities of Arabic script patterns and a limited command of standard Arabic grammar. Cognitive research suggests that students must process content instantly in order to retain it in working memory and make sense of it. Modern teaching methods may offer little reading practice or study of grammatical patterns, so students may read slowly, understand little, and process shorter texts than those administered in international assessments. Thus students' working memory may be unable to contain messages long enough to make sense of them and respond correctly.

To overcome the challenges of visual and grammatical complexity, students studying in Arabic must become fluent and effortless readers by the end of Grade 1, if possible. They should also learn orally and systematically the standard Arabic grammatical patterns needed to comprehend text instantly and precisely. Instructional time must be used to practice these skills and attain automaticity in reading and language comprehension. Pilots have showed sizable effect performance improvement in Grade 1. Interventions that focus on perceptual learning and working memory issues may help Arab countries perform at par with others.

Improving Arab Students' Academic Achievement: The Crucial Role of Rapid Reading and Grammar Mastery in the Early Grades

Helen Abadzi, University of Texas at Arlington

Introduction

The emergence of international assessments has made it possible to compare student performance across countries. Since about 2003, several Arab countries have taken part in these assessments. The results from the various international assessments, such as the Programme for International Student Assessment (PISA), Trends in International Mathematics and Science Study (TIMSS), and Progress in International Reading Literacy Study (PIRLS),¹ reveal that all participating Arabic speaking countries (including the Gulf States) consistently score below the global average. In fact they are at the bottom of the worldwide distributions in reading, math, and science, with fourth graders showing particularly low achievement.

Low performance is particularly pronounced in Arabic-language assessment results. For example, in the fourth grade 2012 PIRLS, the best-performing Arabic-medium schools in Qatar scored approximately 105 points lower than the best-performing English-medium schools (Abadzi & Martelli, 2014). Similar patterns emerged for TIMSS, math and science, where fluent reading is a prerequisite. In addition, national exam pass rates are often low in Arab countries. Comparisons have provided a wake-up call for Arab governments, and there is much interest in improving performance. So, what must be done in the early grades to help students perform at Grade 4 and above?

This paper presents recommendations developed from cognitive science, including Arabic reading research. Briefly, the main challenges in Arabic-language instruction consist of:

- (a) Learning reading through Standard Arabic;
- (b) Learning a vast grammatical framework of verb and noun conjugations;
- (c) Learning vocabulary and expressions that differ from various vernaculars; and
- (d) Learning a number of sounds that are not used in the vernaculars.²

¹ PIRLS provides internationally comparable data on how well students can read in Grade 4. Data are derived from 45 countries that are primarily middle- or higher-income (Mullis, Martin, Foy, & Arora, 2012).

² For a detailed review and original citations, see Abadzi, H. & Martelli, M. (2014). Efficient reading for Arab students: Implications from neurocognitive research. Paper presented at the World Summit of Innovation in Education (WISE), November 5, 2014, Dubai, Qatar.

To explain the issues better, the following section provides an overview of memory functions and their relevance to reading. Subsequent sections also deal with research questions arising out of this situation. The paper concludes with policy recommendations.

Challenges to Arabic-Language Reading Comprehension

Memory Functions and the Complexities of the Arabic Script

As literate adults, we make no active mental effort when we pick up a newspaper and start to read. We do not really perceive letters; we instantly recognize the script and the language, and then we spend most of our conscious time thinking about what we are reading. In reality, we spend the first few milliseconds traversing through a neurological dark tunnel. This is when we use our procedural memory, which contains our knowledge of how letters look, how words sound, what the language says, and which combinations of letters are likely and unlikely. We do not even notice that this process is taking place. Once the procedural memory detects and processes language, our brain must then use our working memory – the type of memory that temporarily holds our present thoughts – to correctly interpret the script within seconds; otherwise its contents get erased (Miller, 1956; Peterson & Peterson, 1959). In other words, we lose our train of thought, and we cannot understand what we are reading.

The implications of cognitive processes are profound. The higher the reading speed, accuracy, and automaticity, the more time students have to think about the content. Therefore, language must be understood instantly and precisely. Critical thinking becomes possible only when people have time to bring various concepts into working memory, link them, and make decisions based on those linkages.

It is easiest to learn reading in languages that consistently represent sounds with letters. With practice the brain connects sequences of symbols into longer patterns. Initially learners read letter by letter. After several hours of practice, a part of the brain that recognizes visual patterns starts processing sequences of symbols (individual letters) into longer units (words). When learners read around 45–60 words per minute, the process becomes effortless and automatic. Then it becomes possible to process large volumes of text. In principle, Arabic learners follow a similar approach. However, unlike most other languages, the Arabic script has certain perceptual features that hinder quick visual processing.

We best recognize letters that have certain spacing between them. Small and dense letters slow down identification, particularly for early readers (Abadzi & Martelli, 2014; Pelli, Tillman, Freeman, Su, Berger, & Majaj, 2007). Our brain also most easily detects shapes that have regular and consistent curvatures, and components that form a coherent shape into a unified “chunk” (Yigal & Sekuler, 2008). However, most Arabic letters consist of multiple parts that the brain does not see as unified. Therefore, Arabic letters may take a few milliseconds longer to recognize compared to other scripts, such as English. Some Arabic writing rules – obligatory separation and connection of letters – may have been historically developed to compensate for this difficulty somewhat, but this may create new detection complexities. Overall, detecting visual cues and patterns becomes more complicated in Arabic, and this inevitably slows down the reading speed for young learners.

Practice helps Arab students become accustomed to small and dense multi-part letters. However, students face another challenge when the short vowel indicators (harakat) are deleted from the written script starting in the third and fourth grades. This is done because vowels are often predictable in Semitic languages, such as Arabic, and expert readers read faster without them (Taha, 2016). Deleting short vowels temporarily slows students down as they spend more time trying to predict likely forms. To predict successfully, students must know Standard Arabic well, but many third and fourth graders do not. Most Arab countries print the TIMSS and PIRLS tests without short vowels, despite the fact that fourth graders may still be learning how to process unvoiced text. Slow and inaccurate reading overloads working memory capacity and may negatively affect responses to test items.

The perceptual elements of Arabic reading and language acquisition have been studied extensively in academia; however, they are often overlooked in curricular and materials development. This disconnect leads education publishers in the Arab world to print textbooks with letters that are too small and dense for young students to read, potentially contributing to a delayed growth in reading comprehension.

The Challenges of Arabic Diglossia

Another major challenge in learning Arabic concerns the differentiation between ancient and more colloquial versions of the language. Diglossia refers to a situation where different varieties of a language are used under different conditions in a country, often by

the same speakers. The colloquial forms are typically used for daily interactions, while the ancient forms are used in formal settings, such as in education, media, and government. The verb and noun endings, expressions, vocabulary, and pronunciation often differ considerably from colloquial forms. Young students who speak only the colloquial dialects may find it hard to make sense of the formal language without training.

Diglossia is deeply embedded in the Arabic culture. Standard Arabic is a linguistic descendent of Classical Arabic, the form used in the Holy Quran, and is therefore a source of pride as it signifies a sense of respect for the Arab world's cultural and religious traditions (Knipp, 2014). Speakers use Standard Arabic (اللغة العربية الفصحى) – to communicate across the Arab world. It is used in all official settings, including in schools, on media channels, and for government-related matters. Each Arab country essentially has its own vernaculars that they use as the dominant mode of communication at the informal level, while simultaneously using Standard Arabic as the *lingua franca*. Arabic dialects differ significantly from Standard Arabic.

Adults who already understand the etymological relationship between formal and informal Arabic may find the transition easy and assume that students will "pick up" the forms, but young children have little experience with dialectic variations and may perceive Standard Arabic as an entirely different language (Eviatar & Ibrahim, 2014). Years may pass before students become proficient.

Teaching Standard Arabic Grammar

Standard Arabic grammar has been hailed as a mathematical miracle. It is very regular with only a few exceptions, but it also contains a plethora of complex components, such as 10 verb forms, each with four to five tenses, conjugated in masculine and feminine genders in the singular, dual, and plural tenses. To acquire knowledge through Standard Arabic, its grammar and rules need to be learned as early as in the first grade.

Children typically learn spoken languages by repeatedly hearing various expressions; this enables them to sample a large number of grammatical items. Their implicit memory thus gathers statistics,

extracts patterns, eventually helping them to gain fluency (Newport & Aslin, 2004). Children are very good at pattern recognition, but they need multiple opportunities to sample various forms. Standard Arabic is not used in daily life, so students cannot sufficiently sample its large grammatical framework. And children must not only learn to understand it precisely, they must learn to read and express themselves in it.

Nowadays, Standard Arabic is taught through a communicative approach through dialogues that implicitly present various grammatical structures. It is common to emphasize communication and authentic texts in language learning, but this can only be justified for languages that are actually spoken in the environment or for languages that have limited conjugations, such as English. Inability or delay in understanding texts written in Standard Arabic inhibits the acquisition of knowledge from texts (Martin, Foy, Mullis, & O'Dwyer, 2011). Thus deficient Arabic comprehension may affect performance in other subjects.

Research in Abu Dhabi, United Arab Emirates (UAE), showed the interaction of language knowledge and visual issues of the Arabic script. The participating first graders had an error rate of 23% (Natour, Darawsheh, Sartawi, Marie, & Efthymiou, 2016, Figure 1; unpublished data for Grade 2 showed 10% error rates). By contrast, European first graders showed almost 0% error rate in reading by the end of Grade 1 (Seymour et al., 2003). This difference in error rates is indicative of perceptual difficulties and suggests that students' working memory may be unable to hold slowly and inaccurately deciphered messages.

Efficient Use of Instructional Time

The amount of language learning required in the first one or two years of schooling in the Arab world would only be manageable with efficient instruction and strict class time budgeting. However, modern education places much emphasis on innovative and fun activities and less on automaticity acquisition. A study of the Gulf countries suggested that many of the innovative activities employed in the classrooms consume considerable instructional time³ and leave less time for basic skills instruction effectively. As a result students may only be able to read single sentences by the end of

³ Classroom observations were conducted in 2016 as part of a project funded by the Qatar National Research Fund in 2013–2016 and by UNESCO–Doha entitled, "Momentum for Education Beyond 2015: Improving the Quality of Learning Outcomes and Enhancing the Performance of Education Systems in GCC Countries." The lead principal investigator was Dr. Faryal Khan of the United Nations Educational, Scientific and Cultural Organization (UNESCO).

Grade 1, whereas their international counterparts may be reading full-page stories. This early difference may set the stage for delays and limited curricular coverage in the subsequent grades. It also means that students may only read texts of 200-300 words by Grade 4, compared to texts of 800-1000 words that students in other countries read. PIRLS uses texts of this length, and many fourth graders are unable to read them and answer questions in 40 minutes.

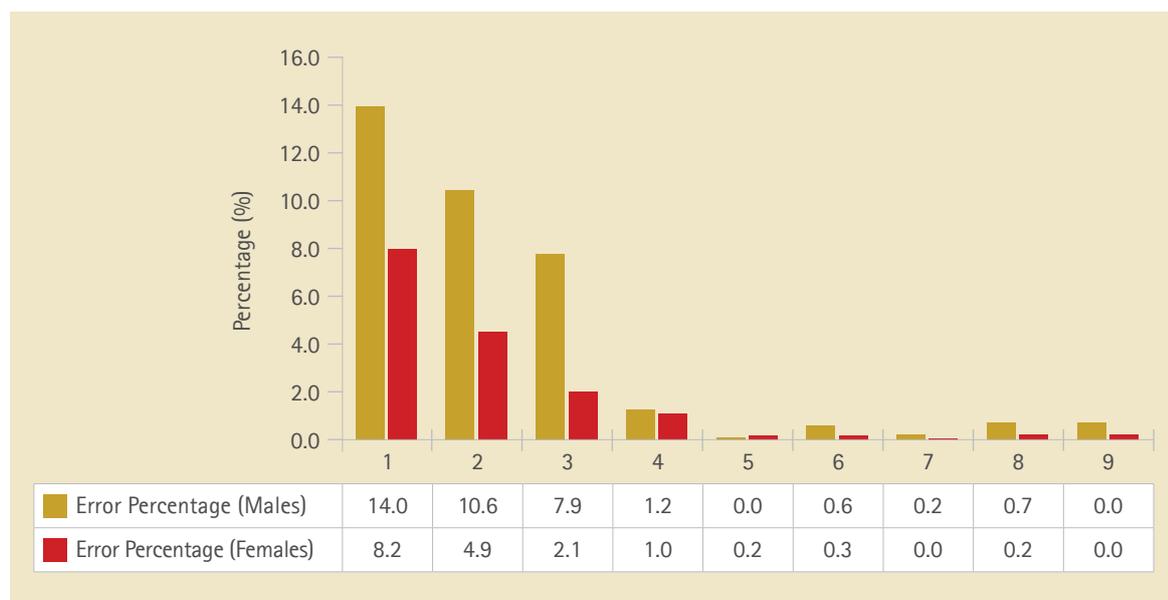
A Reverse Gender Gap

In higher-income countries, girls tend to be slightly better at reading in Grade 1 than boys (Loveless, 2015). This may be partly due to the expression of a language-related gene present among girls (Bowers, Perez-Pouchoulen, Edwards, & McCarthy, 2013). However, in the Arab world, this gender gap is much more pronounced (Taha, 2006). Saudi Arabia, for example, had the highest gender performance gap of all countries tested in PIRLS 2011 (54 point gap) while Kuwait had the highest gap of all participants in TIMSS 2011 (53 point gap). On the TIMSS 2011 mathematics assessment of Grade 8 students, girls in Oman and Bahrain performed 43 and 63 points higher than boys, respectively (Mullis, Martin, Foy, & Arora, 2012). Overall, girls significantly outperform boys in other international assessments and various national examinations across the Arab world.

A study of first graders in Abu Dhabi further illustrates this gender achievement gap (see Figure 1). Boys had a reading error rate of 14%, while girls were nearly half as likely to make these mistakes (Natour, Darawsheh, Sartawi, Marie, & Efthymiou, 2016). The results also resonate with the results of another early-grade reading intervention study conducted by USAID in Jordan, where girls performed better overall as a result of the intervention, with girls in single-sex schools performing best (USAID, 2014). By contrast, boys seemed to get little benefit from the intervention.

Clearly the combination of the Arabic language and script may pose unique challenges. However, single-sex education is an additional variable to consider. In the Gulf States, boys and girls typically attend gender-segregated schools. Girls often have highly educated female teachers who are mostly nationals of the country (Ridge, 2014). On the other hand, national men have a wider range of career opportunities and few pursue teaching. This means that boys are mostly taught by expatriate teachers from Arab countries outside of the Gulf, who bring a vast array of teaching standards and may have been weak students in school themselves (Ridge, 2014). As a result, boys in the Gulf States may be receiving a lower-quality education and be less prepared for the important decision-making roles that they might hold in the future.

Figure 1. Percentages of Reading Error Patterns in Grade 1 Emirati Students, by Gender⁴



Note. Adapted from "Reading error patterns prevailing in Arab Emirati first graders," by Y. S. Natour, W. Darawsheh, A. M. Sartawi, B. A. Marie, and E. Efthymiou, 2016, *Cogent Education*, 3(1).

⁴ The error types in this figure include: 1) inability to read the word; 2) omission of a letter or a syllable; 3) substitution of a letter or a syllable; 4) addition of a letter or a syllable; 5) non-discrimination between the /h/ (al-ha') and the /t/ (at-ta' al-marbouta) at the end of words; 6) non-discrimination between the regular /l/ (al-qamariyya) and the silent /l/ (ash-shamsiyya); 7) not reading the hamza; 8) reading the geminated letter as ingeminated; 9) non-discrimination between *hamzat al-wasl* and *hamzat al-qat'*.

Nevertheless, systematic instruction of the components needed for early-grade texts may be feasible. Children could memorize conjugations and other rules and then practice their application. Despite negative educational philosophies, explicit conjugation of patterns is an efficient method to automatize them into implicit memory. Arabic linguists have codified grammar and created terms for various expressions over the centuries (for example, *idafa* indicates possession). However, Arabic grammar classes in primary school often focus on memorizing definitions rather than patterns (for example, reciting the definition of *idafa* rather than showing multiple patterns of *idafa*). Definitions may not be conducive to increasing the speed and comprehension needed for good performance on international assessments by Grade 4.

To make sense of written or spoken speech, particularly with high volumes of content, instant and effortless performance is required. The overwhelming cognitive load and the effort required for processing Standard Arabic creates a vicious circle—learning through Standard Arabic is difficult and therefore not enjoyable. This way of thinking leads children to resist practicing reading, which means it continues to be difficult. As a result, the necessary visual and linguistic processing speeds necessary to comprehend volumes of text may lag behind for years. One consequence of the complexities discussed above is that few students enjoy Arabic class, enjoy reading, or willingly engage in it (ALECSO, 2013). Many students in the Arab world already read simply as a means to acquire information at school rather than for pleasure (Mullis et al., 2012).

Policy Recommendations

The Gulf governments can use more effective and efficient ways to improve test scores of students studying in Arabic. In the past several decades, the Gulf governments have conscientiously tried to increase achievement levels, often embarking on ambitious reforms. This study suggests that these reform projects should be focused on reading fluency and language command in early grades – particularly in Grade 1. If they succeed, students may require less support in subsequent years and may attain levels similar to those of non-Arab countries. In principle, it should be possible for a child at the end of Grade 1 to read voweled text as fluently as a child of another country with a transparent orthography; and instantly recall the grammatical forms to decipher a text similar to that ready by first graders in other countries.

⁵ While some children may already know how to read from kindergarten or parental help, this cannot be assumed for all.

⁶ More detailed information about the pilot study will be available in a forthcoming Al Qasimi Foundation report.

The specifications of the international tests can be used as benchmarks. Arab governments could prepare students from Grade 1 onwards to read texts of different types that are 800-1000 words long in Grade 4, as is expected by PIRLS. This may seem like “teaching to the test”, but increased processing speed would enable students to go through voluminous texts relatively effortlessly.

As a part of the broader national development plan called Vision 2021, the UAE has currently set an ambitious goal to reach among the top 20 countries in PISA and the top 15 countries in TIMSS by 2021 (UAE Government, 2017). To reach these goals, it is crucial to set concrete plans that would gradually lead the students up to achieving at the expected performance levels. Possible inclusions to the 2021 roadmap are discussed in the subsequent section.

Rigorous Reading Practice in Grade 1 for Automaticity

To facilitate subsequent instruction, this component could be the first step of the process in the first grade.⁵ The activities could include teaching each letter (one at a time), in all positions, with all *harakat* present; emphasizing sounds and letters not found in certain vernaculars (e.g. ض ق غ ث ظ); giving extra practice for difficult letter combinations; increasing the size and spacing of letters; and providing extensive individual reading practice in class every day during Grades 1 and 2.

To prove the concept, the Al Qasimi Foundation prepared a reading textbook aimed at maximizing reading speed on the basis of cognitive science research: large and spaced letters, instruction and extensive practice of individual symbols and combinations, and much material to enable speed acquisition. Foundation staff conducted an informal pilot at the Ibn Dhaher boys' school in Ras Al Khaimah. Two first-grade sections received reading practice during two extra class periods per week over 3.5 months. The students started with lower performance than two control classes but almost doubled the number of letters read on the post-test (23 per minute vs. 12) and the number of words read (11 vs. 6.4). Furthermore, the weakest students made the biggest improvements, demonstrating the power of perceptual learning in the early reading stages.⁶

Explicit Instruction of Standard Arabic in Grade 1

Grade 1 curricula should include oral instruction in Standard Arabic. The main objective would be to teach conjugations of the most common verb forms, negatives, pronouns, and adverbs that differ most from the vernaculars spoken in UAE schools. Vocabulary and syntax would be taught explicitly, and various grammatical features could be contrasted with features used in the vernaculars. Direct instruction may enable weaker students to master and reproduce increasingly complex sequences and understand every word. It can also be complemented by the use of gestures (point to self, others, and shape of objects) to further aid comprehension and memorization (Hanif, 2016).

Teaching Grammar in Early Grades Aimed at Application

Students study Arabic grammar in Grades 2-4, but curricula emphasize nomenclature and definitions, and reading passages remain short. The Arabic curriculum could be revised to use the time for reading of longer passages, and grammatical definitions could be postponed to secondary school. Students in Grades 3 and 4 may also learn less common grammatical forms explicitly and also get sufficient practice reading and understanding texts of longer lengths. Thus they would be able to read 800-1000 words by the beginning of Grade 4.

Repurposing Subjects in Grades 1-2

Given the complexity of Standard Arabic, one 45-minute class per day is insufficient for young students to properly benefit from the proposed explicit instruction in Standard Arabic. The aforementioned early-grade activities may need more time than is typically allocated to Arabic. Until first and second graders become fluent readers, it may be useful to postpone some subjects. Grade 1 curricula often include technology, social studies, and social sciences. The curricula reflect national aims and policies, but given the priority of basic skills, it may be useful to reconsider how to allocate instructional time. It may be possible that some subjects, such as technology and science, could be taught in Grade 2 and above. Focusing on learning Arabic may enable students to read at a higher level and better able to make sense of the academic content.

Greater Scientific Research on Efficient Arabic Reading and Language Instruction

The research that exists certainly serves as a start, but there is a need for state-of-the-art scientific research on efficient Arabic language acquisition. For example, researchers could further test and streamline research-based activities, including:

- Optimizing instruction of letters to attain the fastest reading rate possible;
- Estimating the necessary number of school hours in text processing for automaticity to occur;
- Studying the effects of *harakat* and dependence on them, as speed and vocabulary knowledge increase;
- Studying the effects of writing initiation on reading speed, given phonics instruction;
- Optimizing the appearance of textbooks and recommending revisions to conform to research findings;
- Adapting etymological concepts for young learners to speed up comprehension of standard Arabic, given prior knowledge of dialects; and
- Training teachers on the above issues, in ways that maximize the probability of use.

Conclusion

To think through content and retain needed information, students must process information instantly and effortlessly. The contents of international tests suggest that fourth graders in most countries find 800-word passages feasible. The challenge for the Arab world is to attain a similar rate in the same grade. For that, first graders must be taught reading by practicing individual letters and their combinations for many hours. They must also learn standard Arabic grammar systematically. Practice speeds up processing, until the performance is fluent and automatic. Automaticity frees up mental resources that can be utilized to understand text, engage in mathematical thinking, and deliberate critically about various subjects. Therefore, instructional time should be used to maximize practice and speed up performance. Research on skills acquisition over the past century points the way to a better academic performance for students in the UAE, and the other Arab countries. It is hoped that the Arab world will take advantage of the existing research and improve learning outcomes significantly.

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Helen Abadzi is a professor at the University of Texas at Arlington. She was an education specialist at the World Bank for 27 years and has two PhDs, one in psychology and one in educational administration. Her current research explores cognitive neuroscience applications that may improve early-grade reading fluency.

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