

Original article

Investigation of basic cognitive predictors of reading and spelling abilities in Tunisian third-grade primary school children

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Abstract

Background: This study investigated first the main cognitive abilities; phonological processing, visual cognition, automatization and receptive vocabulary in predicting reading and spelling abilities in Arabic. Second, we compared good/poor readers and spellers to detect the characteristics of cognitive predictors which contribute to identifying reading and spelling difficulties in Arabic speaking children.

Methods: A sample of 116 Tunisian third-grade children was tested on their abilities to read and spell, phonological processing, visual cognition, automatization and receptive vocabulary.

Results: For reading, phonological processing and automatization uniquely predicted Arabic word reading and paragraph reading abilities. Automatization uniquely predicted Arabic non-word reading ability. For spelling, phonological processing was a unique predictor for Arabic word spelling ability. Furthermore, poor readers had significantly lower scores on the phonological processing test and slower reading times on the automatization test as compared with good readers. Additionally, poor spellers showed lower scores on the phonological processing test as compared with good spellers. Visual cognitive processing and receptive vocabulary were not significant cognitive predictors of Arabic reading and spelling abilities for Tunisian third grade children in this study.

Conclusions: Our results are consistent with previous studies in alphabetic orthographies and demonstrate that phonological processing and automatization are the best cognitive predictors in detecting early literacy problems. We suggest including phonological processing and automatization tasks in screening tests and in intervention programs may help Tunisian children with poor literacy skills overcome reading and spelling difficulties in Arabic.

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Keywords: Arabic orthography; Phonological processing; Automatization; Visual cognition; Receptive vocabulary; Reading and spelling

Research on reading acquisition in alphabetic orthographies has revealed that reading and spelling is no easy process for young children and demands the adequate

development of cognitive phonological, visual, rapid naming speed and vocabulary processes. It has been widely accepted that phonological processing represents a core deficit of developmental dyslexia in English speaking countries [1–3]. Individuals with reading difficulties showed poor performance on phonological processing tasks including non-word repetition and reverse order repetition. Moreover, phonological

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processing is known to predict the reading level of normal developing children and also children with poor reading skills [4,5]. However, other findings in cognitive studies argued that phonological processing alone was not enough to account as the sole core deficit of developmental dyslexia. Rapid naming deficit was shown to be a good predictor of reading and spelling abilities in English. There is substantial evidence that poor readers tend to perform slower on rapid naming tasks of letters, digits, colours and objects presented in random order [6–9]. It has been reported that RAN performance in children can distinguish average readers from poor readers [10]. In non-alphabetic orthographies, faster naming time in Rapid Automated Naming trials has been found to be a good indicator of reading competence in Chinese [11] and in Japanese [12]. In transparent alphabetic orthographies such as Dutch and German, RAN was seen to better predict reading ability compared to non-transparent alphabetic orthographies such as English and French [13]. In contrast, other scholars reported that the cognitive abilities underlying reading difficulties are caused by deficits in visual cognitive processing involving deficits in visual memory and visual perception [14]. However, Wolf and Bowers [15] proposed the double deficit hypothesis in which deficits in phonological processing and naming speed represent two independent sources of reading dysfunction, resulting to three subtypes of reading disability. The phonological deficit subtype caused by deficits in phonological processing without affecting naming speed processes. The rate-deficit subtype caused by deficits in naming speed processes alongside with normal phonological processes. Finally, the double-deficit subtype caused by deficiencies in both phonological and naming speed processes [16]. Regarding vocabulary, several English studies have reported that vocabulary knowledge represented an important factor for successful reading in young children [17,18]. Biemiller [19] claimed that the amount of oral experience young children is exposed to may have an important impact on the increase of vocabulary knowledge and children's ability to understand and decode words. Ouellette [20] reported that receptive vocabulary uniquely predicted decoding performance in reading among fourth grade English speaking children. Previous studies also suggested that lexical access (i.e., matching a word to its representation stored in the brain) and comprehension are easier for concrete words than for abstract words [21–23]. Research has also shown that response times in naming [24] and recall tasks [25] are shorter for concrete words than for abstract words when they are presented in neutral sentence or passage contexts. Furthermore, participants are able to think of word and image associates more quickly for concrete words than for abstract words [26]. As memory for abstract words relies more heavily on linguistic coding ability than does memory for

concrete words, poor readers showed to have much greater difficulty on recall of abstract words than did normal readers. However, poor readers' levels of recalling concrete words varied much more in comparison with normal readers [27]. In Kunisue and colleagues' study [28] on comparison between PVT (Picture vocabulary Test, a test widely used internationally as a receptive vocabulary test) and SCTAW, he reported that SCTAW has several advantages over PVT in that SCTAW can be applied in adults, it is a highly sensitive evaluation procedure that does not show ceiling effect among senior grade students' vocabulary and acquired language. In our study, as a receptive vocabulary task, we used ACTAW. With this test, we collected data on 116 third grade Tunisian participating children and calculated the average SD. Thus as ACTAW differs from original Japanese version (SCTAW), vocabulary size would be estimated by the Arabic version ACTAW. As this test is the first time to be used and continues to be in its beginning stages to be developed, more data is needed to be collected from different primary grade levels to fully confirm its validity.

Nevertheless, evidence from cross-linguistic studies suggests that phonological, visual and rapid naming processing in predicting reading and spelling abilities may differ depending on the complexity and different features of orthographic scripts [11,29–31].

Despite advancements in research on reading and spelling in alphabetic, studies on cognitive abilities as predictors of Arabic reading and spelling skills has not been well documented and is of interest. The Arabic alphabet consists of 28 letters, all of which are consonants with the exception of three letters used as long vowels. Arabic orthography includes two kinds of scripts: vowelized Arabic (a transparent orthographic script) and non-vowelized Arabic (a non-transparent orthographic script). There exists no vowelization degree in Arabic. Vowels are presented as diacritical marks located above or below the consonantal letters and carry the phonological information needed to convey a specific meaning of a word. Arabic is read from right to left and all Arabic words are derived from a root composed of three or four consonants conveying the principal meaning of a word. There exists a regular grapheme-phoneme correspondence between Arabic letters and their sounds. The visual complexity of each letter is simple; however, the form of each letter is inconsistent as every letter can take three or more forms depending on its position in a given word (beginning, middle or ending position). In primary school education, children begin to learn to read Arabic using vowelized Arabic. However, skilled and adult readers usually read Arabic using non-vowelized Arabic which is often found in newspapers, magazines, books and in the media. As children move to upper grades in school, the use of vowelized Arabic tends to slowly and gradually fade away.

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