Phonological and cognitive correlates of word-reading acquisition under two different instructional approaches in Greek

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This study examined whether phonological and cognitive tasks correlate with beginning reading acquisition in Hellenic populations under two different instructional approaches: a whole language approach supplemented by implicit coding instruction through incidental learning, as used in Cyprus, versus the syllable-splitting approach characterised by explicit decoding instruction, as used in Greece. Planning, attention, simultaneous, and successive processing tasks together with three phonological coding tasks (Oddity task, Phoneme Elision, and Sound Isolation) were administered to 50 Greek and 50 Cypriot Grade I students. Word Attack and Word Identification were also administered to measure early reading competency. The main findings of the study were as follows: (a) significant group differences were revealed in word-decoding accuracy but not in real-word reading accuracy, an expected finding in a system characterised by high grapheme-phoneme consistency; (b) successive processing and phonological coding consisted of the fundamental abilities that differentiated the Greek from the Cypriot first-graders; and (c) the Greek group exhibited a higher linguistic ability than the Cypriot group. This was facilitated by the use of the distal cognitive processes to reading, that is, successive and simultaneous processing. The discussion focuses on the need to reconsider the nature of early reading instruction in languages such as Greek with high grapheme-phoneme consistency.

Introduction

Cognitive psychology has been particularly interested in the relationship between word recognition and subsequent comprehension. This issue has been central in the debate on beginning reading for more than a century, in a rather reciprocal way, that is, by influencing the argumentation in favour of instructional applications and by being influenced by the
findings of the relative research. Clarity and agreement between theorists with regard to specific approaches in teaching beginning reading has been rare, while there is a strong tendency toward a distinct dichotomy: meaning versus code-emphasis approach.

In practical terms, this has meant that the emphasis has been on the manner in which the code of written English should has to be introduced to the beginning reader and the timing and relative emphasis that should be given to the instruction of the direct code. This emphasis has led to the "Reading wars" that have been well documented in English literature (see for e.g., Adams, 1990; Chall, 1996) but not even adequately addressed in Greek. Although it appears that Flesch's (1955) publication, *Why Johnny can't read* was probably enough to lead to a rapid expansion of a great deal of research in early literacy in English, it was not the case after Vosniadou, Archontidou, Mpimpou, and Papademetriou (1994) translated into Greek the work by Anderson, Hiebert, Scott, and Wilkinson (1985). Thus, we are still confronting the so-called traditional dilemma that requires research to play a vital and somewhat direct role in improving reading instruction. The current controversy revolves around the instructional methods that should be used in teaching Greek to beginning readers. The scope of the current research was to investigate whether different teaching regimes influence the reading strategies that beginning readers adopt, as becomes evident from the cognitive competencies used in reading isolated words.

Several studies in English have suggested that a necessary skill to be mastered in learning to read in the early grades is decoding (Byrne, Freebody, & Gates, 1992; Das, Mishra, & Kirby, 1994; Freebody & Byrne, 1988; Frith, 1992). *Decoding* typically refers to the application of the letter-sound correspondences taught in phonics. Thus, an instructional focus on developing decoding skills early in school is consistent with the relationship of decoding skills and comprehension, especially for children whose only chance to learn to read is in school (Adams, 1990; Foorman, 1994; Foorman et al., 1998). It has been constantly confirmed that strong phonics or decoding programs produce higher reading achievement compared to programs with a less direct instruction in systematic sound-spelling patterns even with weaker readers (e.g., Fletcher, Shaywitz, Shankweiler, Katz, Liberman, Stuebing, Francis, Fowler, & Shaywitz, 1994; Foorman, Francis, & Fletcher, 1998; Torgesen, 1997; Vellutino, Scanlon, Sipay, Small, Pratt, Chen, & Denckla, 1996). This conclusion derives mostly from the evidence supporting a strong connection between children's awareness of the constituent sounds in words and their success in learning to read, which seems to be indisputable for many researchers (Bradley & Bryant, 1985; Kirtley, Bryant, MacLean, & Bradley, 1989; Stanovich, 1993). Moreover, research findings reveal that children who are better at detecting syllables, rhymes, or phonemes are quicker to learn to read (i.e., decode words), and this relation is present even after variability in reading skill due to intelligence, receptive vocabulary, memory skills, and social class is parialed out (Bryant, MacLean, Bradley, & Crossland, 1990; MacLean, Bryant, & Bradley, 1987; Wagner, Torgesen, & Rashotte, 1994).

This empirical relationship is consistent with the idea that some degree of awareness of the phonological structure of words helps to make learning to read words a more understandable task for young children (Torgesen, Wagner, & Rashotte, 1994). Without awareness of the phonological segments in words, the English alphabetic system of writing is not very comprehensible. In addition, the importance of alphabetic script and grapheme-phoneme correspondence knowledge in the English language has been emphasized elsewhere in work done by Liberman and his colleagues (see e.g., Liberman, Shankweiler, & Liberman, 1989) and has been complemented by others (Jorm, Share, MacLean, & Matthews, 1984; Juel, 1988; Stanovich, Cunningham, & Feeman, 1984).

In spite of these findings, advocates of the whole language approach still persist in arguing that *text-level skills* (interpreting the meaning of text) have relatively higher importance than *word-level skills* (centred at simple word recognition) in early reading (Biemiller, 1994). Their line of argumentation is based primarily on the logic of emergent reading (see Whitehurst & Lonigan, 1998, for a definition). Pretending to read and reading environmental print are examples of emergent reading. Advocates within the emergent literacy or whole language approach (e.g., Goodman, 1986) have suggested that this skill demonstrates children's ability to obtain the meaning of text within context.
Consequently, team works or reviews by whole language advocates have attempted to summarise the advantages of this approach to word decoding (e.g., Lehr & Osborn, 1994). They argue that whole language programs seem to be more effective when starting from kindergarten because they provide students with both an overall orientation to what print is used for and how it functions and to specific information about the conventions of written language (Clay, 1985; Guthrie & Alao, 1997; Stahl, 1994). This orientation is considered as one of the strong points of these programs, as it may reflect a strength of language experience approaches and fit in well with certain stage models of reading acquisition (Chall, 1983b; Palincsar, Brown, & Campione, 1993). These stage models suggest that reading develops through several stages from an awareness of the functions to print, to an awareness of the form to print, to automaticity of decoding, to learning to read. It is also accepted that before the children understand the letter-sound correspondences, they need to know what reading is all about and they need to develop motivation toward it (Guthrie & Alao, 1997). Only at this point, are children ready for systematic instruction in decoding. In spite of this theoretical framework, studies have not generally supported a direct causal link between the ability to read environmental stimuli and later word identification skills (Gough, 1993). Therefore, these findings have repeatedly led to the question of how explicit decoding instruction needs to be; whether it has to be implicit through incidental learning and vocabulary knowledge via dealing with generic reading material or deeply explicit through decontextualized letter-sound correspondence training and exercises practised in set texts.

A possible way of responding to this inquiry, that leads to an issue considerably less agreed upon and not adequately studied within the framework of this research, is to address the role that other cognitive processes play in early reading acquisition. This is justified by the fact that tracking the development of cognitive processes or abilities through a primary focus on reading-related phonological skills or a more liberal appraisal related to emergent reading (Whitehurst & Lonigan, 1998) is not an appropriate way to examine a normally distributed reading population. Because of the influence of cognitive factors, the relationship to reading acquisition is not so transparent and, therefore, is disregarded (Das, Parrila, & Papadopoulos, 2000; Papadopoulos, Parrila, Das, & Kirby, 1997; Papadopoulos, Parrila, Das, & Kirby, 2000). As Share (1994) further suggests, “the term ‘phonological processing’ should be reserved strictly for abilities evident in non-reading tasks, and whose development is not primarily contingent on literacy experiences” (p. 149). On the other hand, although the focus on children’s development of broader literacy knowledge has occasionally provided us with rich evidence of the ways children interact with literacy materials (Palincsar et al., 1993), generally, “it has neither examined the convergent and independent properties of this knowledge nor demonstrated a causal relation between the development of this knowledge and the development of conventional literacy” (Whitehurst & Lonigan, 1998; p. 854).

Assessment of a beginning reading population, using a set of measures that are not directly related to reading competence, but which can provide us with necessary information to better understand the cognitive processes involved in such a complex activity as reading, appears to be essential. This approach requires a well-grounded theoretical framework that should meet three basic criteria: (a) to treat phonological awareness not as a "unitary, invisible insight or ability" (Juel, 1988; p. 437) but rather to provide, more operating interpretations of reading ability (or disability); (b) to go beyond phonological coding in order to detect those cognitive processes that collectively account for an equal variance in early reading ability, in the same way as phonological coding; and (c) to go beyond the cognitive structures related to text comprehension, as they are factors more difficult to measure as well as weaker predictors of text difficulty compared to the word's predictive value (Chall & Dale, 1995; Chall, 1999).

Such a framework would be surely more congruent with teaching methods emphasizing mostly conventional literacy skills, such as the analytic-synthetic method, which consists of the emphasis of the present paper. This, however, does not mean that the research tradition that focuses on the development of knowledge which is specific to vocabulary, syntax, narrative structure, metalinguistic aspects of language and so forth is not also important in the understanding of the acquisition of conventional reading. Fluent reading involves a number of
component skills and processes. A reader must decode units of print into units of sounds and units of sounds into units of language. Arguably, being able to say a word or series of written symbols is only a part of reading. The fluent reader is the one who can also understand those auditory derivations, which involves placing them in the correct conceptual and contextual framework. The present paper, however, does not deal with these latter component skills.

These criteria, however, have only been met in reading difficulties’ research. A vast majority of the studies have attempted to define those parameters that influence early reading acquisition, and whose absence or inadequate development may lead to early reading problems (e.g., Byrne, Freebody & Gates, 1992; Das, Mishra, & Kirby, 1994; Porpodas, 1999; Share, 1995; Torgesen, Wagner, & Rashotte, 1994). In this case, then, the question is as follows: Do other cognitive processes beyond phonological coding and early literacy experiences add to the explanatory power of a model predicting early word reading especially in light of the fact that two different instructional approaches were used?

To reply to this question we need to focus the search on the relevant cognitive processes. The first constraint, also acknowledged by Share and Stanovich (1995b), should be that the suggested cognitive processes, as well as the tasks that are used to operationalize them, have to be theoretically meaningful and appropriate in terms of reading acquisition. The second, educational constraint is that the diagnosis of such processes is not alone sufficient, but should further have implications for remediation (Papadopoulos et al., 2000; Parrila, Das, Kendrick, Papadopoulos, & Kirby, 1999). The PASS (planning, attention, simultaneous, and successive) model’s cognitive processes and the tasks used to operationalize them meet both these constraints (Das et al., 2000). Although the relations between PASS components and reading skills have been recently explained elsewhere (see e.g., Das, Naglieri, & Kirby, 1994; Das et al., 2000), it is presented next an account, a brief one, of the cognitive basis of word reading as it has been developing in the research literature utilizing PASS theory (see e.g., Das, Mishra, & Kirby, 1994; Kirby, Booth, & Das, 1996; Papadopoulos et al., 1997, 2000). Also, it is probably sufficient to say that in a concurrent to this study, Papadopoulos et al. (2000) examined the causal relationship between the PASS components and reading skills with an at-risk population in kindergarten. The authors found that performance on both successive processing and phonological tasks for a group of 90 kindergarten children being at-risk for developing reading difficulties, correlated significantly with reading skills one year later, in Grade I. Moreover, three “systems” – phonological, successive, and simultaneous – together distinguished between those children who were diagnosed as nonreaders or poor readers and those who were not. The risk of remaining a nonreader, in tum, was predicted by extremely poor level of performance on two successive and two phonological tasks. Thus, given these findings, the theoretical framework that incorporates both the PASS theory and the findings from traditional research on phonological coding provides an explanation for word reading in the present study.

Word reading: Distal and proximal cognitive processes

When confronted with a word, a beginning reader can either recognize the word by sight, attempt to guess the word from context, or decode the string of letters in terms of their respective sounds or phonemes; this activity is usually referred to as phonological coding. Sight reading and guessing from context are strategies commonly associated with poor rather than fluent reading (see e.g., Share, 1995) whereas phonological coding is the most commonly used strategy of competent readers. The reason is simple: the spoken lexicon is far bigger than the words that can be recognised by sight or reliably guessed at from the context.

Thus, when a beginning reader is confronted with a previously unseen word, he or she is faced with at least five interrelated tasks, which must be undertaken to reliably recognize the word. First, all (or at least most) of the letters have to be recognized and differentiated from their visually confusing neighbors (e.g., b-d, g-q-p; O-D, E-F, V-Y). Second, the sounds (phonemes) of the letters or letter combinations must be retrieved and differentiated from their phonetically confusing neighbors (e.g., /θ/-/θ/; /ɿ/-/ɿ/, /h/-/h/, /h/-/h/). Third, all phonemes must be stored in working memory in their exact order of presentation. Fourth, the entire set of phonemes in
working memory has to be blended together to form a phonological representation of the whole word. Finally, this phonological representation of the word has to be used to gain access to the lexicon. If the word is in the child's (spoken) lexicon, he or she can move on to the next word.

To accomplish these five tasks a beginning reader will require the use of both proximal and distal cognitive processes as well as the necessary knowledge base without which the processes will be void of content. In the context of word reading, the necessary knowledge base can be defined as consisting of two components: (a) knowledge of letters/letter combinations and the sounds they make, and (b) a spoken lexicon that allows the recognition of words after they have been sounded out. The proximal cognitive processes are the mostly linguistic skills that are directly related to the five tasks mentioned above. The most frequently recognized proximal processes in word reading are phonological processes, defined commonly as cognitive processes that deal directly with the sound structure of the spoken language. The distal cognitive processes, on the other, are more general and modality unspecific underlying cognitive processes. These enable the development of proximal processes. Thus, the influence that distal cognitive processes have on reading is not necessarily direct but can be mediated by one or several proximal processes. More specifically, we have elsewhere suggested (Das et al., 2000) that two types of cognitive processes are relevant for word reading: (a) those that contribute to the development of phonological and orthographic processing (successive and simultaneous processing), and (b) those that allow the successful deployment of phonological and orthographic skills (planning and attention). The PASS (planning, attention, simultaneous and successive processing) theory of intelligence (Das, Naglieri, & Kirby, 1994) includes both kinds of processes.

The present study

In recent years, we have seen that research dealing with early literacy provides an unrestrained definition of literacy that is often extended to any situation in which an individual interacts with the printed environmental stimuli through the use of a symbolic system. However, in this paper we restrict our focus to more conventional forms of literacy and especially the reading of isolated real words and non-words. This was decided for two reasons: First, because of the mere fact that the aspect of reading as a process of decoding letters into corresponding sounds and linking those sounds to single words has not been adequately researched in a transparent language as Greek (Whitehurst & Lonigan, 1998). And second, because there are a number of specific cognitive factors that have been implicated in the acquisition of conventional reading skills and we needed to replicate the findings in the Greek language (e.g., Share, 1995). The investigation of these same aspects in a writing system characterized by higher grapheme-phoneme consistencies than those found in English may lead to interesting observations (see also Porpodas, 1999).

Method

Participants

Two groups of fifty Grade 1 students (27 and 25 females for Cyprus and Greece, respectively) from 4 public schools – in Larnaca, Cyprus and Athens, Greece – all native speakers of Greek, participated in the study. The two groups were matched in age, gender, and socio-economic status. The mean age of the Cypriot group was 6.3 years ($SD=0.40$) and the mean age of the Greek group was 6.43 ($SD=0.46$) when children were tested in April 2000.

Instructional reading groups. The reading curricula of the participating schools were giving different emphases on factors involved in reading and literacy. A short description of these curricula follows next.
The Cypriot group. The Cypriot group was taught using the whole-language approach. The whole language approach stressed the reading and comprehension of real texts over practice in other aspects of reading. Big books, experience charts, and book handling experiences, along with children's own writing and group projects on defined thematic sessions were some of the regular activities in the Cypriot classrooms. The aim of the approach was two-fold: (1) to enable students to integrate new and known information through their own reading and writing, and (2) to enable students to communicate their own learning with meaningful statements that summarize the text they have read. Only incidentally, were students dealing with word decoding and letter-sound correspondences, whereas most of the reading activities focused on sentence analysis. To attain these objectives, students participated in group discussions, and long periods of reading and writing. The students read fine children's literature, much of it from well-stocked classroom libraries. Teachers often demonstrated reading strategies and relevant skills, as for example, in the context of storybook reading and retelling. Share reading was also very frequently used, as both teachers and children became engaged in real dialogues about the story they had read. The children tried to generate their own questions about the text, to relate their own knowledge to newly acquired knowledge found in the text, to summarise what they had read, and to identify what they found confusing in the text in order to comprehend it. Word recognition strategies, in contrast, involved a lot of use of context cues. When children encountered an unknown word, they were more likely to use picture cues, skip unknown words, and comment about the story rather than reading the story word by word. Also, students were constantly instructed to read whole sentences almost by memorising them, rather than by trying to systematically read shorter sentences or sentence fragments. It was believed that these strategies would contribute to better performance on measures of word recognition in isolation, even though words were rarely, if ever, presented that way in this whole language setting. Teachers acted as facilitators rather than directors of learning.

The Greek group. The Greek group, in contrast, was taught through the analytic-synthetic method that provided explicit instruction in letter-sound correspondences through syllable-splitting activities. There was a sort of balance of phonological awareness (with segmentation and blending as the key strategies) and literature activities, using books designed by the Greek Ministry of Education. Phonological awareness activities were introduced to the students through the use of sound-spelling cards, alliteration activities, and controlled vocabulary text. Also, spelling exercises that moved the student from phonetic spellings to conventional spellings were used. Finally, writing workshop activities and collections of poetry, non-fiction, and fiction were introduced by mid Grade I.

To acquire additional information on the practices guiding the two approaches to reading, participating teachers completed, retrospectively, a questionnaire that addressed instructional methods of reading. Their answers indicated that the teaching methods adopted were rather distinctive: the Cypriot group of teachers replied that 90% of their time was devoted to whole-word method and reading in context; only the remaining 10% of their reading instruction was relatively phonics based. In contrast, the Greek group of teachers emphasized the fact that reading in context was only occasionally practiced, covering, in approximation, 20% of their 80-min reading instruction time. Their predominant goal was to provide an eclectic phonics-based instruction, without, however, providing inadequate more generic literature experiences.

Measures

Cognitive processing tasks

Ten tests (two planning, two attention, two simultaneous processing, and four successive processing) taken from the standardisation version of Das-Naglieri Cognitive Assessment System (DN-CAS; Das & Naglieri, 1993) were used to assess participants' cognitive processing skills. A pilot study, for standardisation purposes in Greek, took place before this study was
conducted (Papadopoulos & Georgiou, 2000). The reliability of these tests in Greek was equivalent to that of similar studies in English (Das et al., 1994). More specifically, the Guttman Split-Half Reliability Coefficients were as follow: Planned Search and Planned Connections, .55 and .54, respectively; Expressive Attention and Receptive Attention, .77 and .71, respectively; Simultaneous Verbal and Figure Memory, .73 and .70, respectively; and for Word Series, Sentence-Repetition, Sentence-Questions, and Speech Rate were .83, .81, .80 and .93, respectively.

Planning tasks

Planned search. This task required the participant to develop an efficient scanning strategy to find a particular target on a page. The version that was used in this study consisted of 16 items with each item consisting of two tasks per page. The target pattern was located in a small box at the center of each task and the subject was instructed to find an identical pattern among those in the distracting field. The participant’s score was the time taken to complete all items.

Planned connections. The Planned Connections task required the subject to develop some effective way of connecting sequential stimuli (numbers from 1 to 25), which are quasi-randomly distributed on a page. In this study, the task consisted of six items. The participant’s score was the combined time to complete items 1 to 6.

Attention tasks

Expressive attention. This task is based on the Stroop task that was first composed by Stroop (1935) and has since been widely used as a measure of interference. The version used in this study was composed of three pages, all of them containing animals. Participants were shown animals which were either “small” (a butterfly, a mouse, a bird, and a frog) or “big” (an elephant, a whale, a horse, and a dinosaur) and asked to refer to their actual size. In Item 1, all of the pictures were of the same physical size; in Item 2, the size of the pictorial representation was in accordance with actual size; and in Item 3, the pictorial presentations of the animals did not follow their actual size. The participant’s score was the item 3 completion time divided by number of correct responses.

Receptive attention. This task was developed by Naglieri and Das (1987). The participants were given four sheets consisting of 50 picture pairs each. In the first two items, the participants’ task was to underline only those pairs of pictures that were visually alike (picture matching). Alternatively, in the last two items, the participants were instructed to underline those pairs that belong to the same taxonomic category (name matching). The participant’s score was the combined time to complete items 3 and 4 divided by the total number of correct responses in these items.

Simultaneous processing tasks

Simultaneous verbal. This 29-item task involved evaluation of logico-grammatical relationships by the participants, who were asked to point to one of the six pictures that corresponded with a verbal statement, such as “the ball in a basket on a table”. The time limit for each item was 45 seconds and the task was discontinued after 4 consecutive errors. The test was scored for the number of correct responses.

Figure memory. This task consisted of 20 geometric designs, such as a triangle or a square, that were presented to the participant one at a time for a period of five seconds each. Following the presentation of a particular target design the participant was given a more complex design in which the target design was embedded. The participant then was asked to outline the original target. The task was discontinued after 4 consecutive failures. The participant’s score was the total number of items correctly reproduced.
Successive processing tasks

Word series. This test required the subject to repeat a series of words in the same serial order that the examiner used. The series increased in length from two to nine words. All of the nine words used were highly familiar and phonetically dissimilar. The number of words series recalled correctly constituted the score of the participant.

Sentence repetition. In this task, the participant had to repeat nonsensical sentences in which the content words have been replaced by color words (e.g., "The yellow greened the blue"). Thus, the participant could use syntactic cues but no semantic cues to remember the sentences. The participant’s score was the number of correctly reproduced sentences. The task was discontinued after 4 consecutive failures.

Sentence question. In this task, the participant had to answer questions about the same nonsensical sentences that were used in the Sentence Repetition task. Thus, again, the participant could use syntactic cues but no semantic cues to answer the questions. The participant’s score was the number of correctly answered questions. The task was discontinued after 4 consecutive failures.

Speech rate. In this task, the participants were required to say aloud three familiar and phonetically dissimilar words (e.g., "Man, Cow, Key") as fast as possible for 10 times. The task consists of eight three-word series and the participant’s Speech Rate score was the combined time to complete all eight items.

Phonological tasks

Oddity task. This task was adapted to Greek and was based on the work by Bradley and Bryant (1985). The child was required to listen to three words presented orally and to identify the one that had a different initial or final sound compared to the other two. The task consisted of 8 test items and the participant’s score was the number of correct items.

Sound isolation. This task was also a Greek adaptation of the work of Wagner, Torgesen, Laughon, Simmons, & Rashotte (1993) where they compared alternative models of young readers’ phonological processing abilities. In this test, children were asked to repeat the first, last, or middle sound in a word. Four practice items and 15 test items consisting of three- and four-phoneme, one- and two-syllable words were included. The task was discontinued after four failures. The participant’s score was the number of correct items.

Phoneme elision. This task was also an adaptation of the work by Wagner et al. (1993). In this task, children were asked to repeat a word after deleting an identified phoneme. The targeted phonemes were either vowels or consonants and their position varied across items. After deleting the target phoneme, the remaining phonemes formed a word. Fifteen test items were used. The task was discontinued after four mistakes. The participant’s score was the number of correct items.

Reading tasks

The participants’ reading ability was assessed through two different tasks involving the reading of real words and pseudowords. Both reading measures were Greek adaptations of Woodcock’s Reading Mastery Test-Revised (1987).

Word identification. This test consisted of 85 words forming a 2x2x2 factorial design in terms of frequency (high/low), orthographic regularity (regular/exception), and length (bisyllable/trisyllable). Due to the absence of standard frequency counts in Greek, half of the words were sampled from the first-grade language books, and the other half taken from second-grade language books. The stimulus words were mainly nouns with a few adjectives and verbs.
**Word attack.** This test consisted of 45 pronounceable non-words that were derived from real words after changing two or three letters (either by substituting them or using them backwards). The task started with bisyllabic words and ended with five-syllabic words.

**Procedure**

All participants attended two individual testing sessions lasting from 30 to 40 minutes each. During these sessions, participants were administered the phonological, cognitive, and reading tasks. All testing took place during school hours in a private room in the participants' respective schools.

**Results**

Table 1 presents the two groups' performance in reading words and nonwords as well as the significance of differences between the two groups on these measures. It is evident that the word decoding (reading nonwords) performance of the Cypriot students was significantly lower than that of the Greek students. These results suggest that the type of reading instruction had a differential effect on children's early reading skills. Students who were instructed with the whole-language approach appeared to be less capable of applying a grapheme-by-grapheme strategy in reading especially nonwords. The fact, however, that even the Cypriot group succeeded in accurately reading almost 65 real words on average (77.0%) suggests that reading in a regular writing system such as Greek allows even those students who have been instructed to recognise isolated words mostly as a whole, to decode many of the letter arrays successfully. It is not surprising, however, that this positive performance did not generalize into nonword reading, which requires a well-grounded knowledge that words are composed of sounds, a competency not developed well by conventional whole language approaches (Byrne & Fielding-Barnsley, 1993).

Table 1

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<th>Accuracy scores for Greek and Cypriot groups on reading tasks</th>
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<td>Cypriot group (n=50)</td>
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<tr>
<td><strong>Word identification</strong></td>
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<td>Word identification</td>
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<td>Word attack</td>
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Table 2 displays the group means and standard deviations on the two planning, two attention, two simultaneous, four successive, and three phonological tasks as well as the significance of the group differences on each task. MANOVA analysis (2 groupsx13 variables) indicated that the main effect of Group was significant, Wilks' L=.543, F(13,86)=5.57, p=.000, for all 13 tests. The overall picture emerging from the analysis is that the two groups differed significantly (mostly in favor of the Greek group) on several measures. Subsequent univariate analysis showed that the tasks that proved to create a stronger distinction between the groups in word-reading were the Oddity task, the Planned Connections task (in favor of the Cypriot group), the Word Series, as well as the Sentence Repetition and Sentence Questions and Speech Rate tasks. It is apparent that successive processing and fundamental phonological abilities (as expressed by the Oddity task) play a prominent role in differentiating the Greek
readers from the Cypriot readers, a differential effect that could be attributed to the type of instruction received. This is even better received, when looking at the group performances on the simultaneous processing tasks, in which no significant differences were observed, implying that both groups had equally developed their simultaneous processing skills through whole and analytic-synthetic approaches, alike, to word-reading. Thus, in sum, these results indicate that the participants in the Greek group were characterized by somewhat better successive and basic phonological processing skills, as compared to the Cypriot group, a performance that coincides with their enhanced word-reading performance (see Table 1). When considering the results of Table 1 and 2 together, support is provided for the argument that some of the distal cognitive processes (i.e., successive processes) have been developed along with the fundamental proximal phonological processes of reading for the Greek group at a higher rate than for the Cypriot group.

Next, in order to examine the roles of phonological and cognitive correlates to reading tasks, inter-correlations were conducted. Table 3 displays the significant correlations between cognitive and phonological scores and Grade I reading group membership (whole-language for the Cypriot group vs. code instruction for the Greek group). The first two columns present the correlations with the Word Identification task (WID) and the second two, those with Word Attack (WAT).

For the Cypriot group, word-recognition skills (WID) appeared to be significantly correlated with two phonological tasks (Phoneme Elision and Sound Isolation), one simultaneous processing task (Figure Memory) and at least three of the successive processing tasks (except Sentence-Questions). In contrast, for the Greek group, real word reading was highly correlated only with the same two phonological tasks (Phoneme Elision and Sound Isolation), Receptive Attention, and Planned Connections. These results indicate that there were more significant
correlations in the results of the Cypriot group and only a few in the results of the Greek group in relation to real word reading. In the Cypriot group substantial associations were found between the WID and a number of measures of phonological awareness, simultaneous and successive processing. In the case of the Greek group, in contrast, only two of the phonological measures were associated with real word reading beyond a planning and an attention task.

The respective correlations for Word Attack revealed more similarities than differences between the two groups. In sum, all three phonological tasks, at least one of the simultaneous processing tasks (both for the Greek group) and at least one of the successive processing tasks (all but the Sentence Questions for the Cypriot group) correlated significantly with Word Attack (WAT) scores. In addition to that, Planned Connections and Receptive Attention kept revealing significant correlations in word decoding for the Greek group.

Taken together, these correlations indicate that successive, simultaneous and phonological processing skills correlated significantly with real and pseudoword reading in the Cypriot sample – with the phonological processing tasks revealing the highest correlations. Moreover, the tasks that correlated significantly with pseudoword reading, in the Greek group, were partly different from the tasks that correlated significantly with the ability to read familiar words (WID). In either case, however, phonological processing skills appeared, again, to play a predominant role in reading isolated words.

Table 3
Correlations of both cognitive and phonological tasks with reading tests by instruction group

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cypriots (n=50)</th>
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<th>Cypriots (n=50)</th>
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<tr>
<td>Planned connections</td>
<td>-.202</td>
<td>-.340*</td>
<td>-.190</td>
<td>-.488**</td>
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<tr>
<td>Attention</td>
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<tr>
<td>Expressive attention</td>
<td>-.163</td>
<td>-.195</td>
<td>-.156</td>
<td>-.178</td>
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<tr>
<td>Receptive attention</td>
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<td>-.344*</td>
<td>-.247</td>
<td>-.280*</td>
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<td>.206</td>
<td>.207</td>
<td>.327*</td>
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<td>Figure memory</td>
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<td>.269</td>
<td>.372**</td>
<td>.438*</td>
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<td>Successive processing</td>
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<td></td>
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<tr>
<td>Word series</td>
<td>.376**</td>
<td>.254</td>
<td>.386**</td>
<td>.275</td>
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<tr>
<td>Sentence repetition</td>
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<td>.243</td>
<td>.361**</td>
<td>.317*</td>
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<td>Sentence questions</td>
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<td>.141</td>
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<td>.197</td>
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<tr>
<td>Speech rate</td>
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<td>-.068</td>
<td>-.488**</td>
<td>-.004</td>
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<tr>
<td>Phonological processing</td>
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<td></td>
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<td></td>
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<tr>
<td>Oddity task</td>
<td>.274</td>
<td>.269</td>
<td>.329*</td>
<td>.394*</td>
</tr>
<tr>
<td>Sound isolation</td>
<td>.797**</td>
<td>.461**</td>
<td>.768**</td>
<td>.481*</td>
</tr>
<tr>
<td>Phoneme elision</td>
<td>.772**</td>
<td>.861**</td>
<td>.765**</td>
<td>.738*</td>
</tr>
</tbody>
</table>

*Note.* 1Latency measures; 2Accuracy measures.

To further examine the roles of phonological and cognitive processes as predictors of the dependent variables (that is, real word and nonword recognition) stepwise regression analyses were conducted. In each regression analysis the phonological and cognitive measures were introduced into the regression according to the stepwise method, whereby at each step, the independent variable not in the equation which has the smallest probability of F is entered, if that probability is sufficiently small. Variables already in the regression equation are removed
if their probability of F becomes sufficiently large. The method terminates when no more variables are eligible for inclusion or removal.

According to these analyses, in the group of Greek children, Phoneme Elision and the Oddity task turned out to be the most important predictors for both word recognition (WID) and word decoding (WAT) accuracies (Table 4). In addition to that, Figure Memory, a simultaneous processing task, appeared to contribute to word decoding. On the other hand, in the group of Cypriot children, the regression analyses showed that Sound Isolation and Phoneme Elision were the only two predictors that contributed considerably to reading of real words and non-words. In sum, these findings provide additional evidence that those literacy skills are likely to be processed in a somewhat different way by the two groups, depending on the regression pattern within each group. Thus, this evidence is in support of the qualitative differences in word-reading strategies between the two groups.

Table 4
Results of regression analyses for word identification and word attack

<table>
<thead>
<tr>
<th>Measures (dependent variable)</th>
<th>Predictor (independent variable)</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greek group</td>
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<td></td>
<td>Oddity task</td>
<td>.688</td>
</tr>
<tr>
<td>Word attack</td>
<td>Phoneme elision</td>
<td>.545</td>
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<tr>
<td></td>
<td>Figure memory</td>
<td>.600</td>
</tr>
<tr>
<td></td>
<td>Oddity task</td>
<td>.647</td>
</tr>
<tr>
<td>Cypriot group</td>
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<td></td>
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<tr>
<td>Word identification</td>
<td>Sound isolation</td>
<td>.636</td>
</tr>
<tr>
<td></td>
<td>Phoneme elision</td>
<td>.691</td>
</tr>
<tr>
<td>Word attack</td>
<td>Sound isolation</td>
<td>.590</td>
</tr>
<tr>
<td></td>
<td>Phoneme elision</td>
<td>.811</td>
</tr>
</tbody>
</table>

Finally, in order to see how the phonological and cognitive variables were correlated among each other, full correlation matrices were computed. Table 5 reports these intercorrelations (Pearson Correlations). The correlations are presented separately for the 50 participants in Cyprus (above diagonal) and the 50 participants in Greece (below diagonal).

Firstly, although there were significant correlations among the cognitive and phonological variables, the vast majority of the correlations were lower than .5, and this reduced the possibility for threat of collinearity among the predicting variables. There are some significant correlations, however, in both analyses to which we should pay some attention: significant correlations were observed between attention tasks, simultaneous processing tasks, successive processing tasks, as well as phonological processing tasks. These correlations were expected based on the results of several past studies, as well as on the theory associated with the use of them (Das, Naglieri, & Kirby, 1994; Wagner et al., 1994). On the other hand, the Planned Connections task was highly correlated with the Attention and the Simultaneous processing tasks for the Greek group. This result may imply that, for this group, a prerequisite of Planned Connections, a visual matching skill, may have assumed more importance than the strategies for locating and connecting the numbers in the field. The test probably involves target identification rather than search strategies and may therefore tap more into attention and simultaneous processing than into planning.

Also, in both analyses, Sound Isolation and Phoneme Elision were significantly correlated with Simultaneous Verbal, Word Series, and Sentence Repetition tasks. They also correlated with Speech Rate for the Cypriot group and Sentence Questions for the Greek group. This
may have some theoretical importance in terms of explaining reading skills (or difficulties) through both phonological and successive processing. The connection between phonological and successive processes has also been shown in previous work in English (Das, Parrila, & Papadopoulos, 2000; Papadopoulos et al., 1997) and this replication partly encourages us to support additional conclusions in favour of this argument.

Table 5

Inter-correlations (Pearson-correlations) among cognitive and phonological variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
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</thead>
<tbody>
<tr>
<td>1 - Planned Search</td>
<td>.32*</td>
<td>.04</td>
<td>.32*</td>
<td>.54</td>
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<td>.07</td>
<td>.01</td>
<td>.06</td>
<td>.07</td>
<td>.03</td>
<td>.02</td>
<td>.05</td>
<td></td>
</tr>
<tr>
<td>2 - Planned Connections</td>
<td>.43**</td>
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<td>.40**</td>
<td>.27</td>
<td>.31*</td>
<td>.15</td>
<td>.11</td>
<td>.01</td>
<td>.16</td>
<td>.02</td>
<td>.20</td>
<td>.30*</td>
<td></td>
</tr>
<tr>
<td>3 - Expressive Attention</td>
<td>-.33*</td>
<td>-.49**</td>
<td>.34*</td>
<td>.41**</td>
<td>-.29*</td>
<td>-.25</td>
<td>.09</td>
<td>.16</td>
<td>.15</td>
<td>-.33*</td>
<td>-.05*</td>
<td>-.08</td>
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<tr>
<td>4 - Receptive Attention</td>
<td>-.46**</td>
<td>-.39**</td>
<td>.53**</td>
<td>-.16</td>
<td>-.19</td>
<td>.04</td>
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<td>.07</td>
<td>-.27*</td>
<td>-.31*</td>
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<td>-.47**</td>
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<td>.24</td>
<td>.44**</td>
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<td>6 - Figure Memory</td>
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<td>-.45**</td>
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<td>.16</td>
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<td>.43**</td>
<td>.42**</td>
<td>.34*</td>
<td>-.34*</td>
<td>.27</td>
<td>.40**</td>
<td>.58**</td>
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<td>7 - Word Series</td>
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<td>-.18</td>
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<td>.42**</td>
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<td>.31*</td>
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<td>.51**</td>
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<td>.39**</td>
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<td>8 - Sentence Repetition</td>
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<td>.42**</td>
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<td>9 - Sentence Questions</td>
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<td>-.26</td>
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<td>.75**</td>
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<td>.12</td>
<td>.24</td>
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<td>10 - Speech Rate</td>
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<td>.06</td>
<td>.13</td>
<td>-.09</td>
<td>-.22</td>
<td>-.23</td>
<td>.43**</td>
<td>.53**</td>
<td>.47**</td>
<td>-.15</td>
<td>.65**</td>
<td>.56**</td>
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<td>11 - Oddity Task</td>
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<td>.37**</td>
<td>.46**</td>
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<td>.50**</td>
<td>-.35*</td>
<td>.22</td>
<td>.22</td>
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<tr>
<td>12 - Sound Isolation</td>
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<td>-.33*</td>
<td>.01</td>
<td>.31*</td>
<td>.39**</td>
<td>.40**</td>
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<td>.35*</td>
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<td>.47**</td>
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<td>.36*</td>
<td>.38**</td>
<td>-.13</td>
<td>.56**</td>
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</tr>
</tbody>
</table>

Note. Above diagonal, Cypriot participants; below diagonal, Greek participants, n=50 in each group; * p=.05; ** p=.01

Discussion

The results of the present study clearly indicate that the two instructional approaches have a differential phonological and cognitive influence over the reading skills of Grade 1 Hellenic populations. Children who were directly instructed in syllable splitting and the alphabetic principle exhibited, especially in word decoding, a significantly higher performance than children who were indirectly instructed in the alphabetic principle through exposure to reading literature. Real word reading accuracy, however, was almost equally high for both groups of children. This result may imply that when reading a regular writing system like modern Greek, beginning readers manage to decode many of the letter series successfully, regardless of the instructional approach they have received. The same phenomena have been observed in other phonetically regular languages as well (Jiménez & Guzmán, 2000; Wimmer, 1993). This finding, however, did not generalize into pseudoword reading, which directly measures phonological decoding. Moreover, the two groups generally appeared to rely on
different processes to successfully decode isolated words as was shown by the examination of the cognitive processes involved in reading. Indeed, Table 2 showed that the two groups could be distinguished in terms of their performance on all four successive tasks and on one of the phonological tasks. The Greek group of children appeared to have a better odd word-out performance, better performance on the successive processing/memory tasks and faster speech rate. Thus, teaching technique appeared to act as a determinant of reading strategies.

Considering the overall results, the question arises: Why and how the two groups differed in the way they read isolated real and pseudowords? A possible explanation may derive from the nature of the reading tasks themselves. To distinguish among beginners in terms of their reading knowledge, we assessed their ability to read isolated words varying in difficulty and to read pseudowords words, as is usually recommended (Ehri & McCormick, 1998). Word Identification involves recognition of familiar words that may be recognised as a whole. Since the word can also be recognised as one unit in contrast to being read phonetically, as in the case of pseudowords, the application of simultaneous processes, as is evident by the high correlation with Figure Memory in the Cypriot group (Table 3), might provide some explanations for the relatively high scores obtained by this group in reading real words. Sight-reading is one of the earliest strategies that assists children’s early reading and it is expected that it will be used by students who have been taught to read words as single units. Sight-reading, however, is not a generalizable strategy, and this becomes evident by the Cypriot group’s performance on the word-decoding measure. Successful phonological and successive processing, in turn, requires that the participant translates graphemes into phonemes one at a time, and then maintains both the identity and the position information of translated phonemes intact in verbal working memory while translating the remaining graphemes of the target word. The use of phonological processing strategy was evident in the entire sample, as was indicated by the fact that two of the phonological coding tasks correlated significantly with Word Identification performance for both groups. Successive processing, however, appeared to also correlate significantly with Word Identification in the case of the Cypriot group, indicating that there were qualitative group-differences in reading real words.

The above group differences were moderated on deciphering pseudowords. Here, both Greek and Cypriot groups’ reading performance correlated significantly with a number of both proximal and distal cognitive processes. Table 3 indicated that the tasks that correlated significantly with pseudoword reading (WAT) were different from the tasks that correlated significantly with the ability to read familiar words (WID). It is certainly no surprise that all phonological tasks correlated significantly with Word Attack in both groups. Similarly, it is perhaps not surprising that Figure Memory and at least one of the successive tasks, Sentence Repetition, correlated with the Word Attack variable in the entire Hellenic population. They both belong to the distal cognitive processes whose role may be more general and non-specific in relation to reading, but which processes are highly necessary for reading to occur (Das, Naglieri, & Kirby, 1994; Vellutino & Denckla, 1996). The qualitative group differences, in the case of Word Attack, were located in the significant correlations between Speech Rate and Word Series, two other successive processing tasks, with reading pseudowords in the case of the Cypriot students. It appears that for a more efficient use of phonological loop (Baddeley, 1986) both Speech Rate and verbal STM, as expressed by the word-span task, needed to contribute to the deciphering of unfamiliar words. In sum, these results lead to certain implications with regard to reading development, adding weight to the findings on WID. When young readers in Greek are confronted with the demanding task of reading low-frequency words or pseudowords, they make use of almost the same skills regardless of the instructional program they have received. This, however, does not necessarily mean that they use these skills with the same effectiveness.

Results from regression analyses also provided additional evidence for the qualitative differences between the groups, especially in their utilization of phonological information at word-reading level (Table 4). The fact that among the phonological tasks, the oddity task seemed to be the most important predictor for literacy acquisition in the Greek group probably means that this task may function as a successive processing task as it incorporates this kind of
processing – its correlations with the successive tasks were also significant (Table 5). Thus, successive processing capability in itself may not affect literacy learning, although some aspects of it, as they expressed via the oddity task, may influence the process of learning to read. Also, the result that Figure Memory contributes to reading of pseudowords provides an additional support that for the Greek group, reading is facilitated by both phonological, that is, proximal, and cognitive, that is, distal, processes. On the other, the fact that regression analyses showed that Cypriot first-graders appeared to rely extensively on phonological skills to read real words and non-words, might be explained by the nature of Greek language. One could argue that it seems that even whole-word-trained readers appear to eventually acquire decoding skills, at least those who make progress in learning to read. Or to say it in other words, phonological decoding is not regarded as a necessity for sight word learning but merely as a facilitator. Probably, in transparent languages as Greek, we need to draw a distinction between the strategies used by beginners to read words (i.e., by sight, by decoding) and the method of instruction they receive (i.e., phonics vs. whole word). Readers may receive one type of instruction, but whether or not they use the instructed approach in their reading may be influenced by other factors as well. Sight word reading is likely not a unitary process for them, nor is it a way of reading words that is limited to students who receive sight word instruction.

Overall, it appears that the findings that have been extensively documented in the English language are also replicated in the Greek language. The analytic-synthetic method that mainly focuses on syllable-splitting and explicit code instruction facilitates reading development differently than the whole-language approach does. The Greek group that has been instructed via the analytic-synthetic approach has developed a higher linguistic ability, meaning that children's sensitivity to syllables facilitated the use of specific abilities, namely those of successive and simultaneous processing. It also appeared that the Greek children were at an advantage in the task where the use of phonological coding was obligatory, that is, the Word Attack. This finding is in accordance with the idea that learning to read through an approach that provides more direct emphasis on systematic sound-spelling patterns not only develops the analytical and blending skills of children, but also leads them to utilize phonological information more often and probably at the expense of other forms of information (Share, 1995). This is at least what earlier studies also have shown with English speaking populations (e.g., Johnston & Thompson, 1989). In their study of first-graders, Johnston and Thompson concluded that the New Zealand children who had been instructed through the whole language approach were more likely to make their decisions, while reading a word, on the basis of visual information alone when not explicitly required to use a phonological approach. The use of phonological processing strategies, on the other, in tasks where it was obligatory was also possible but not at the same level of effectiveness as with the British children who had been instructed via a more systematic grapheme-to-phoneme approach. This is likely the case with the Cypriot group in the present study.

At this point, there is also a need to comment again on the decision made to include only word-reading measures to assess reading ability. In the first volume of the Handbook of Reading Research, Gough (1984) began his review on word recognition by noting that “Word recognition is the foundation of the reading process” (p. 225). Research shows that word recognition is the foundational process of reading. However, it is also generally acknowledged that to emphasize the centrality of word recognition is not to deny that the ultimate purpose of reading is comprehension. This also implies that skill, at the word recognition level, is so central to the total reading process that it can serve as a proxy diagnostic for the effectiveness of instructional methods (Adams, 1990). To a certain extent, the present findings support this position by showing qualitative group differences deriving from the different instructional methods received by the two groups of Hellenic first-graders.

In general, the results of the present study proved that reading at the word-level can produce group differences at the level of the development of the competencies used in reading isolated words, coinciding with the results of other studies in transparent (Jiménez & Guzmán, 2000) and non-transparent orthographies (Seymour, 2000). In addition, examining group differences at the word-reading level enhanced the association of certain cognitive and
phonological abilities in word decoding and word recognition, using two different instructional approaches. Therefore, this finding is particularly important as it translates into instructional practices.

Greek, after all, as a language of transparent orthography, seems to function qualitatively better through a letter-to-sound correspondence instruction. To teach the parts of the words after a story has been read to or by the children, or to teach the psychological units of the syllable as usually happens in English (letter-onset and letter-rime correspondences) may be not considered, after all, as a competitive method of instruction in Greek. To develop deciphering abilities in Greek, it appears that the young reader needs an explicit, systematic, and extensive instruction of grapheme-phoneme correspondences. This is the instructional method that may gradually lay to rest the argument that has plagued the history of reading instruction in Greek. Perhaps, we need to take into account what Jeanne Chall (1995) so eloquently suggested in her commentary paper to Share and Stanovich (1995a): “Although the Greeks found a simple way to teach reading, we seem to go through periods of accepting, then rejecting it, then accepting it again. The same for the research... Why does practice follow research so poorly? Why do we have to discover again and again what was known for nearly 3000 years? In a time when our economy requires that more individuals read better than even before, we cannot afford to ignore the research that the authors so lucidly updated for us” (pp. 84-85).

References


Cette enquête examine phonologiquement et cognitivement les méthodes nécessaires pour le début de l'acquisition de la lecture dans la population Hellénique, en deux différents types d'instruction: toute la langue d'un approche supplémentaire, sous-entendu, d'une instruction codée d'un enseignement symptomatique, comme il est utilisé en Chypre, contre l'approche division de la syllabe, caractérisée de l'instruction explicite du décodage, utilisé en Grèce. Le plan, l'attention, la simultanéité, les méthodes successives du processus, avec les trois tâches phonologiques (la tâche de la singularité, l'élimination du phonème et l'isolation du son) étaient données aux 50 étudiants Grecs, et 50 étudiants Chypriotes de premier degré. L'attaque du mot et son identification étaient aussi utilisées pour tester la première compétence de la lecture. Les résultats de l'enquête étaient: (a) des différences significatives étaient révélées à la précision du décodage du mot, mais ce n'était pas le cas à la précision de la lecture du vrai-mot, un résultat normal dans un système caractérisé d'une haute consistance du graphème-phonème; (b) un progrès successif et décodage phonologique qui différencient les étudiants du premier degré entre la Grèce et le Chypre et (c) le groupe grec a montré une habileté linguistique plus élevée que le groupe chypriote. C'était facilité de l'usage d'un processus cognitif double, qui est un processus successif et simultané. La discussion est centralisée sur la nécessité de reconsidérer la nature de la première instruction de la lecture, quand aux langues comme le Grec avec une haute consistance du graphème-phonème.

Key words: Cognitive and phonological abilities, Early reading development, Early reading instruction, Reading acquisition, Word reading.

Received: December 2000
Revision received: June 2001

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