Magda Soares and beginning literacy: Why is reading and producing texts not enough?*1

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Abstract

This article aims to discuss Magda Soares' views on the explicit teaching of the alphabetic writing system, examining, through a bibliographic review, works she has published since the last millennium. Upon reviewing these positions, it becomes evident that, while she had already expressed concerns in the 1980s about the abandonment of explicit alphabetic writing instruction, it was after the turn of the 20th to the 21st century that she became notably committed to combating what she termed the "de-invention of beginning literacy" and advocating for the necessity of a planned and systematic approach to teaching alphabetic writing, starting in early childhood education, as implemented in the "Alfaletrar" initiative, developed in the municipality of Lagoa Santa, Minas Gerais, Brazil. By problematizing the dichotomy between "constructivist teaching" and "explicit teaching," Magda Soares argued that the choice between these approaches depends on the nature of the knowledge being acquired: the former being more suitable for understanding the alphabetic principle, and the latter for learning the conventional relationships between graphemes and phonemes. The study concludes that, although she was a pioneer in promoting beginning literacy from a sociocultural perspective, Magda Soares never "disregarded" the teaching and learning of alphabetic writing as a fundamental component of early written language acquisition.

Keywords

Beginning literacy - Literacy - Magda Soares - Teaching of alphabetic writing.

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Introduction

Magda Becker Soares (1932–2023), born in the capital of Minas Gerais, Belo Horizonte, Brazil, earned her degree in Neo-Latin Languages from the Federal University of Minas Gerais (UFMG), where she became a Full Professor Emerita at the School of Education, of which she was also one of the founders. In 1990, she conceived and founded the *Centro de Alfabetização, Leitura e Escrita* (CEALE) [Center for Literacy, Reading and Writing], and during that same decade, she took part in establishing the "Literacy" Working Group of the National Association of Graduate Studies and Research in Education (ANPEd). Although she formally retired in 1998, she continued working well into her late eighties, having designed and implemented the *Alfaletrar* project in the Municipal School System of Lagoa Santa, a city in the metropolitan region of Belo Horizonte, Minas Gerais (MG).

Among her works, several books stand out for their significant impact on the fields of literacy and Portuguese language teaching in Brazil: *Linguagem e escola: uma perspectiva social* (1986) [Language and school: a social perspective]; *Letramento: um tema em três gêneros* (1990) [Literacy: a theme in three genres]; *Alfabetização e letramento* (2003) [Teaching to read and write and literacy]⁴–a collection in which she republished some of her seminal articles, such as *As muitas facetas da alfabetização*, (1985) [The multiple facets of beginning literacy]; *Alfabetização: a questão dos métodos* (2016) [Teaching to read and write: the question of methods]; and *Alfaletrar: toda criança pode aprender a ler e a escrever* (2020) [*Alfaletrar:* every child can learn to read and write]. Since the 1960s, Magda Soares had also published textbooks, including the well-known series *Português: através de textos* [Portuguese through texts], *and later, in the 1990s, Português: uma proposta para o letramento* [Portuguese: a proposal for literacy].

What legacy did Magda Soares leave us regarding the teaching of the alphabetic writing system, which she considered the linguistic facet of early written language learning—that is, learning to read and write? In this article, we address this question by drawing on a bibliographic review of works published by the author since the 1980s. The selection was guided by a focus on what she referred to as the "linguistic facet," which constitutes the central concern of this article. To that end, we analyze the articles *As muitas facetas da alfabetização* (Soares, 1985) [The many facets of beginning literacy], *Alfabetização: em busca de um método?* (Soares, 1990) [Teaching to read and write: in search of a method?], and *Letramento e alfabetização: as muitas facetas* (Soares, 2004a) [Literacy and teaching to read and write: the many facets], in addition to her two most recent books, *Alfabetização: a questão dos métodos* (Soares, 2016) [Teaching to read and write: the question of methods] and *Alfaletrar: toda criança pode aprender a ler e a escrever* (Soares, 2020a) [*Alfaletrar:* every child can learn to read and write]. We also refer,

⁴⁻ Translation note: In this article, the terms "teaching/learning to read and write" and "beginning literacy" are used to refer to "alfabetização", a concept in Brazilian educational discourse that denotes the initial phase of learning to read and write, specifically the mastery of the alphabetic writing system. In this case, beginning literacy is distinct from "literacy" (letramento), which encompasses the broader and socially situated uses of written language.



as supplementary sources, to other works by the author, including articles, book chapters, books, and interviews she gave.

Without aiming for exhaustiveness, we analyze the content of the selected texts by excerpting and comparing passages that explicitly express the positions Magda Soares held over the years regarding the teaching of the alphabetic writing system. It is important to clarify that throughout her academic career on *alfabetização* (teaching/learning to read and write – also referred to here as beginning literacy), *letramento* (literacy), and other subjects in the field of Portuguese language education, Soares did not rely on a single theoretical reference. Instead, she engaged with a variety of perspectives. In her two final books (Soares, 2016, 2020a), she explicitly acknowledged that while constructivist perspectives with Piagetian foundations–such as those of Emilia Ferreiro and Ana Teberosky (Ferreiro; Teberosky, 1979)–were useful for understanding the early stages of the literacy process, other theories, such as Linnea Ehri's (2013) "connectionist model" grounded in experimental research, were more appropriate for grasping the more advanced stages of mastering phoneme–grapheme correspondences.

This article begins by discussing some evidence of Soares' concern over the abandonment of explicit instruction in the alphabetic writing system prior to the turn of the century. Next, we reflect on how Magda Soares, over time, conceptualized the linguistic facet of early written language learning. In the third section, we examine the proposals she advocated for teaching the alphabetic writing system, particularly as they emerged from her experience in Lagoa Santa, MG, and as systematized in *Alfaletrar*. Finally, we present some of Magda Soares' critical views regarding the prescriptions for teaching the alphabetic writing system put forth by the *Base Nacional Comum Curricular* (BNCC – the Brazilian Common Core State Standards), the phonics method, and the *Política Nacional de Alfabetização* (PNA – National Policy for Learning to Read and Write).

Evidence of Magda Soares' concern about the abandonment of explicit alphabetic writing instruction since the last millennium, when she was already advocating for the use of real texts in beginning literacy

In Brazil, during the second half of the 1980s, innovative winds were blowing through the field of reading and writing instruction. On the one hand, the reception of the constructivist theory of the Psychogenesis of Written Language (Ferreiro; Teberosky, 1979) sparked a strong critique of traditional reading and writing instruction methods for their associationist view of learning, while calling on educators to shift their focus toward understanding "how students learn" rather than simply "how to teach." On the other hand, the emergence of a socio-interactionist approach to language teaching (Geraldi, 1984) advocated that reading and producing real-world texts should be both the starting point and the goal of Portuguese language classes—replacing the classic focus on grammatical nomenclature and taxonomies, or the production of "school-style essays" and the reading of artificial texts.



In the context of early reading and writing instruction, Magda Soares was one of the pioneers who embraced the fight for reading and writing real texts in classrooms where children were first introduced to the world of writing. Long before the term "literacy" [*letramento*] and its associated concepts became widespread in Brazil, Soares was already pointing out that abandoning "primer-style" or "pseudo-texts" was a key step toward overcoming the country's historical failure to teach children from working-class backgrounds how to read and write.

In 1988, in a classic article titled *Alfabetização: a (des)aprendizagem das funções da escrita* [Beginning literacy: the (un)learning of the functions of writing], while discussing different linguistic perspectives (which she termed "structural" and "functional") and issues of dialectal variation across social classes, Magda Soares observed how the texts produced by children from low-income communities often mirrored the "models" of juxtaposed phrases to which they had been exposed in traditional primers (Soares, 1988). Yet when these same children wrote notes to their teachers, Magda Soares noted that

[...] the children, in addition to allowing themselves to write "untrained" words, thereby constructing and testing hypotheses about sound-letter correspondences, used writing for personal and interactional purposes: they expressed their feelings, and interacted with their teacher. They demonstrated an appropriate concept of writing: a means of reaching an absent interlocutor and achieving a personal goal of interaction (Soares, 1988, p. 10).

Nearly a decade later, with the publication of *Letramento: um tema em três gêneros* (Soares, 1998) [Literacy: a theme in three genres], Professor Magda Soares would widely disseminate, across different levels of analysis, the concept of *literacy* and the view that we must engage in "*alfabetizar letrando*"—that is, to teach the alphabetic writing system alongside social practices of reading and writing texts from various genres. This perspective quickly gained traction and was adopted by nearly everyone involved in beginning literacy research and teacher training in Brazil.

Nonetheless, our author—who was among the first to claim that "teaching children to read and write has many facets," as we will discuss later—had already expressed deep concern years earlier about the spread of proposals advocating a *methodless approach to literacy instruction*. In 1990, in the article *Alfabetização: em busca de um método?* [Teaching to read and write: in search of a method?], Soares observed that, more than a decade after the arrival of "constructivism" in Brazil, many teachers remained disoriented, relying on the idea that children should be left to "discover how the alphabetic writing system works" on their own—something she considered highly risky. Concluding the article, Soares (1990, p. 50, emphasis in the original) stated:

Without clear methodological propositions, we run the risk of worsening school failure: either because we reject traditional methods in the name of a new conception of reading and writing acquisition without guiding teachers on how to "translate" research findings into renewed classroom practice; or because we fail to resolve the conflict between a constructivist approach to teach how to read and write and the orthodoxy of the school; or, finally, because we may



fall into spontaneism, mistakenly assuming, due to insufficient theoretical grounding, that *any* activity is an intellectual one and that *any* conflict is a cognitive conflict.

In the explanatory note that Magda Soares (2003a) added when republishing the same article in the collection *Alfabetização e letramento* [Teaching to read and write and literacy], she points out that, already in the previous millennium, she recognized a limitation in the theory of the *Psychogenesis of Written Language*. According to the author,

[...] this paradigm became hegemonic, and as a consequence, the need to complement and integrate it with linguistic paradigms was disregarded, since learning to read and write is not only a process of conceptualizing writing, as psychogenesis describes and explains, but is also, and simultaneously, a process of appropriating a *linguistic object*—the written language—an object and process that linguistic sciences describe and explain (Soares, 2003a, p. 96, our emphasis).

It is worth noting that Magda Soares was already referring to a "linguistic object," which—as we will see in the following section—she would later call the "linguistic facet," although in the earlier quote she still referred to it more generally as "written language," and not specifically as the "alphabetic writing system," "representation system," or "notation system," as she would later do (with some variation in terminology) in her works *Alfabetização: a questão dos métodos* (Soares, 2016) [Teaching to read and write: the question of methods] and *Alfaletrar: toda criança pode aprender a ler e a escrever* (Soares, 2020a) [*Alfaletrar*: every child can learn to read and write]. In any case, she was already insisting that in order to learn this object, it is not enough for the child to develop "conceptual understandings"—such as grasping that writing represents the sound segments of words rather than their meanings. As she argued, to master this object, children must also learn conventions as complex as the relationships between graphemes and phonemes and the various syllabic structures of words in Portuguese.

More recently, these disagreements with Emilia Ferreiro and her followers were made explicit in an interview Magda Soares gave to Ana Ruth Moresco Miranda. When explaining her divergence regarding the differentiated use of the terms and concepts of *"alfabetização"* (teaching/learning to read and write – also referred to here as beginning literacy) and *"letramento"* (literacy), the author clarified:

My disagreement with Ferreiro was that words, once their meaning has been acquired and consolidated, are not easily altered or redefined, and *alfabetização* has always been understood as the learning of the alphabetic writing system. The meaning of words is not something we can change at will... Furthermore, my main argument is pedagogical in nature: appropriating the alphabetic system requires specific linguistic and cognitive learning tied to that object, and therefore a specific form of instruction, based on linguistic sciences, while using the alphabetic system to write texts involves a fundamentally different kind of learning, grounded in other foundations [...] (Soares, 2022, p. 12).



Looking back in time, we can see that concerns about a generalized neglect of systematic instruction in the alphabetic notation system in Brazil were the focus of several "manifesto-texts" Soares published in the years following her first major critique in 1990. We refer here to the revised and expanded arguments presented in articles such as *Letramento e alfabetização: as muitas facetas* (Soares, 2004a) [Literacy and teaching to read and write: the many facets], *A reinvenção da alfabetização* (Soares, 2003b) [The reinvention of beginning literacy], and *Alfabetização e letramento: caminhos e descaminhos* (Soares, 2004b) [Learning to read and write and literacy: paths and pitfalls].

Although she continued to alternate in how she referred to the alphabetic writing system—sometimes calling it a "code" in the aforementioned articles—Soares took a clear stance in those works: incorporating the concept and perspective of *letramento* (literacy) into *alfabetização* (teaching/learning to read and write – also referred to here as beginning literacy) does not eliminate the need to teach the alphabetic writing system itself. She called this the linguistic facet of early written language learning, a notion we will explore in more depth in the following section.

The linguistic facet of early written language learning in Magda Soares' perspective

In the mid-1980s, Magda Soares published the emblematic article *As muitas facetas da alfabetização* (Soares, 1985) [The many facets of beginning literacy] in *Cadernos de Pesquisa*, a journal of the Carlos Chagas Foundation. In this article, she outlined her initial proposal regarding the multiple facets of early written language learning—a proposal that, over the years, was restructured and disseminated in later works such as *Letramento e alfabetização: as muitas facetas* (Soares, 2004a) [Literacy and teaching to read and write: the many facets], which explicitly revisits the 1985 article; *Alfabetização: a questão dos métodos* (Soares, 2016) [Teaching to read and write: the question of methods]; and *Alfaletrar: toda criança pode aprender a ler e a escrever* (Soares, 2020a) [*Alfaletrar:* every child can learn to read and write]—all of which have become essential references in the field of teaching reading and writing in Brazil.

In the classic 1985 article, which aimed to "[...] highlight some of the main facets of the process of teaching how to read and write that have been the subject of study and research" (Soares, 1985, p. 20), Magda Soares already hinted, it seems, at an early concern with what she would, many years later, call the "de-invention of beginning literacy," as we will discuss further on. In this sense, she expressed a concern about attributing an overly broad meaning to beginning literacy, which would imply a denial of the specificity of the process,

[...] pedagogically speaking, attributing too broad a meaning to the process of teaching how to read and write would mean denying its specificity, with undesirable consequences for the characterization of its nature, the configuration of basic reading and writing skills, and the definition of competence in teaching literacy (Soares, 1986, p. 20).



In discussing the concept of *alfabetização* (teaching/learning to read and write—also referred to here as beginning literacy), Magda Soares identified three different perspectives on the phenomenon in the 1985 article, which would later be referred to, in her 2016 work, as distinct facets of early written language learning: "learning to read and write as the process of representing phonemes with graphemes and vice versa," "learning to read and write as a social process." These three conceptions unfolded, in her 1985 theorization, into the well-known multiple facets of literacy—psychological, psycholinguistic, sociolinguistic, and linguistic. This led her to defend literacy as a complex, multifaceted process that must necessarily be studied through multiple scientific lenses.

The perspective adopted by the author also incorporated the social, economic, cultural, and political factors that condition the beginning literacy process. In her words: "A coherent theory of beginning literacy will only be possible if the articulation and integration of the various facets of the process are contextualized socially and culturally and illuminated by a political stance that restores its true meaning" (Soares, 1985, p. 23). From early on, Magda Soares expressed a clear concern with the fact that school failure in beginning literacy disproportionately affected children from lower-income backgrounds: "[...] the beginning literacy process in schools is perhaps more marked than any other school-based learning by discrimination in favor of socioeconomically privileged classes" (Soares, 1985, p. 23).

While in the classic 1985 article Magda Soares already argued that beginning literacy was essentially linguistic in nature–even while recognizing its many facets–it was only at the beginning of the current millennium that the linguistic facet, which for her came to be synonymous with beginning literacy (*alfabetização*), assumed a central place in her intellectual work. In the article *Letramento e alfabetização: as muitas facetas* (Soares, 2004a) [Literacy and teaching to read and write: the many facets], published nearly 20 years later in the *Revista Brasileira de Educação*, the author denounced the phenomenon she originally termed the "de-invention of beginning literacy," referring to the erasure of instruction in the alphabetic writing system, and called for its "reinvention." In that article, Soares (2004a) explicitly developed the premise of a lost specificity in the process of learning to read and write⁵–a concern she had already voiced in 1985 and 1990.

At the same time that she defended the specificity of *alfabetização* (understood as the learning of the alphabetic writing system), Magda Soares upheld the inseparability of learning to read and write and literacy (*letramento*) as a non-negotiable principle, without falling into the mistake of the so-called "de-invention of beginning literacy," in which the two processes are merged, with the predominance of the literacy phenomenon. In fact, what the author strongly criticized was, above all, the idea "[...] that merely through intense exposure to written materials circulating in social practices—that is, through immersion in written culture—a child will learn to read and write" (Soares, 2004a, p. 11).

⁵⁻ This perspective was also addressed by the author in the articles *Alfabetização e letramento: caminhos e descaminhos* (Soares, 2004b) [Learning to read and write and literacy: paths and pitfalls] and *A reinvenção da alfabetização* (Soares, 2003b) [The reinvention of beginning literacy], published respectively in the journals *Pátio* and *Presença Pedagógica*.

Returning to the metaphor of facets, first introduced in 1985, Magda Soares argued, in her 2004 article, that both learning to read and write and literacy have different facets. In the case of learning to read and write, the distinct facets she described are "[...] phonological and phonemic awareness, identification of phoneme–grapheme relationships, skills for coding and decoding written language, knowledge and recognition of the processes for translating the spoken form of speech into the graphic form of writing" (Soares, 2004a, p. 15). This perspective led the author to argue that the different natures of the facets of learning to read and write and literacy require distinct teaching methodologies, "[...] some characterized by direct, explicit, and systematic instruction–particularly those involved in learning to read and write, in its various facets–others characterized by incidental, indirect instruction, subordinated to children's possibilities and motivations" (Soares, 2004a, p. 16).

Finally, in her work *Alfabetização: a questão dos métodos* [Teaching to read and write: the question of methods], Magda Soares (2016) defines three facets of early written language learning–linguistic, interactive, and sociocultural–which, in a way, revisit the three concepts of *alfabetização* discussed in her 1985 article. The "linguistic facet"–which, in this book, is considered equivalent to *alfabetização*–refers to the appropriation of the alphabetic writing system and its conventions. Meanwhile, the "interactive" and "sociocultural facets", which together constitute literacy (*letramento*) in the author's perspective, involve, respectively, the comprehension and production of written texts and the social and cultural uses of writing. In a footnote, however, the author acknowledges that "[...] these facets not only fail to encompass all components of the complex phenomenon that is early written language learning, but each of them could also be broken down into several components–this categorization is, like all categorizations, reductive" (Soares, 2016, p. 28).⁶

In the work *Alfaletrar: toda criança pode aprender a ler e escrever* (Soares, 2020a) [*Alfaletrar:* every child can learn to read and write], Magda Soares translates these three facets into layers that together constitute the whole–namely, early written language learning: the appropriation of the alphabetic writing system; the reading and writing of texts (uses of writing); and the social and cultural contexts in which writing is used. As in her 2016 book, the first layer refers to learning to read and write (*alfabetização*), while the other two constitute literacy (*letramento*). According to the author, they are

[...] learning processes that overlap, forming a whole. Each type of learning is distinct from the others by its own processes, but they are interdependent—each depends on the others, just as learning the alphabetic writing system is necessary in order to read and write, using it in the cultural and social situations where writing is present (Soares, 2020a, p. 19).

Returning to the work *Alfabetização: a questão dos métodos* (Soares, 2016) [Teaching to read and write: the question of methods], which constitutes a rigorous and detailed state of the art in the field of early reading and writing instruction, we emphasize that Magda Soares focuses on the "linguistic facet," while never losing sight of the whole:

⁶⁻ In the introductory note to the version of the article Letramento e alfabetização: as muitas facetas [Literacy and teaching to read and write: the many facets], published in the collection Alfabetização e letramento, Soares (2003a, p. 29) acknowledges that "[...] the initial proposal of the many facets progressively became more complete, while also becoming more precise."



early written language learning, composed of the three different facets. When clarifying her choice to focus on the "linguistic facet," the author clearly explains that it is "[...] the foundation for the other two facets, which fundamentally depend on the correct and fluent recognition (in reading) and production (in writing) of words" (Soares, 2016, p. 36).

As we have already pointed out, from her classic 1985 article onwards, Soares consistently advocated for a specific and distinct understanding of *alfabetização*, that is, the learning of the conventional writing system, even while recognizing it as a complex and multifaceted phenomenon.

In the 2016 book we are referring to, Soares problematizes the dichotomy between "constructivist teaching" and "explicit teaching," a discussion she had already introduced in her 2004 article, where, as we have seen, she argued that some facets of early written language learning would require direct, explicit, and systematic instruction, while others would involve incidental and indirect teaching. Just as she reconciles contributions from different and sometimes divergent theoretical and epistemological perspectives—such as the constructivist paradigm represented by Emilia Ferreiro and the phonological paradigm defended by Linnea Ehri–Soares (2016) argued, based on a careful critical review of the available literature, that the choice between "explicit teaching" and "constructivist teaching" should depend on the nature of the knowledge objects being taught.

In these terms, the author began to argue more clearly that "constructivist teaching" would be more appropriate for helping children grasp the alphabetic principle—that is, the discovery that letters represent minimal sound segments of language—while "direct and explicit teaching" would be more suitable for learning the conventional relationships between graphemes and phonemes. This argument is preceded by an in-depth review of studies on these relationships in Brazilian Portuguese and on the varied syllabic structures of words in our language. Our author also makes a point of analyzing the specificities of "word reading" and "word writing," areas that are often neglected by those involved in the initial or continuing education of teachers specializing in early reading and writing instruction.

In her work *Alfaletrar: toda criança pode aprender a ler e escrever* [*Alfaletrar:* every child can learn to read and write], Soares (2020a) clarifies that, in an initial phase, the child (re)discovers that words are sounds—that is, sound chains that can be segmented into parts—and only later begins to learn the cultural invention that is the notation of the smallest sound units of the language, the phonemes, by alphabet letters. According to the author: "Access to this *invention* becomes apparent when the child shows awareness of the relationship between the letters in a syllable and the 'sound' they represent (the syllabic level with phonetic value)" (Soares, 2020a, p. 120). For this reason, Soares (2016) emphasizes that the period preceding the full understanding of the alphabetic principle does not exclude the learning of phoneme-grapheme correspondences. In this sense, she argues that "[...] the phonological paradigm becomes appropriate, and even inevitable, starting from the period when children begin phoneticization in writing" (Soares, 2016, p. 120). Thus, the author acknowledges that this paradigm provides the foundations for a necessarily explicit teaching of phoneme-grapheme correspondences.



Soares (2016) also clarifies that, although the learner's conceptual constructions in the process of understanding the alphabetic principle cannot be directly taught, this does not imply an absence of teaching—that is, it does not mean renouncing pedagogical actions that provoke and guide "[...] the processes of constructing, deconstructing, and reconstructing hypotheses and forming concepts, grounded above all in the constructivist paradigm" (Soares, 2016, p. 340). In a footnote, the scholar even explicitly states that "[...] it is not valid to claim that the constructivist orientation eliminated method in early reading and writing instruction" (Soares, 2016, p. 335). Thus, the author revisits the argument already developed in her article *Alfabetização: em busca de um método?* (Soares, 1990) [Teaching to read and write: in search of a method?], namely, that there is no incompatibility between the constructivist conceptual paradigm and a method for teaching to read and write, one that is not restricted to the traditional synthetic or analytical methods.

Although since the 1980s Magda Soares had defended the view that learning to read and write is essentially a linguistic process involving the appropriation of the alphabetic writing system and its conventions, in her most recent work she acknowledges that: "Being able to read and comprehend texts and to write texts is what characterizes a child who, in addition to *having acquired the alphabetic system*, has *become truly literate*, which is the goal of the cycle of learning to read and write and literacy" (Soares, 2020a, p. 200). In fact, as early as 1986, she had already asserted that:

One would not consider a person "literate" if they were only able to decode visual symbols into sound symbols, "reading," for example, syllables or isolated words, nor would one consider "literate" a person incapable of, for example, adequately using the orthographic system of their language when expressing themselves in writing (Soares, 1986, p. 21).

Based on these positions, we will next discuss the proposals that Magda Soares presented for the planned and systematic teaching of the alphabetic writing system, drawing from the experience she lived and systematized in the book *Alfaletrar* through her work in the municipality of Lagoa Santa, Minas Gerais.

Explicit teaching of the alphabetic writing system:

foundations, curriculum, and practices in Lagoa Santa, Minas Gerais, and in the book *Alfaletrar*

As explained in her final work, *Alfaletrar: toda criança pode aprender a ler e a escrever* [*Alfaletrar*: every child can learn to read and write], Magda Soares (2020a) conceives the "period of learning to read and write"—which requires explicit teaching of the alphabetic writing system from the perspective of literacy—as an extended one. It should begin during the final two grades of early childhood education and continue until around the age of eight, that is, through the third grade of elementary school (Soares, 2020a). This position had already been adopted by the author at least ten years earlier, in an article published in a special issue of the journal *Educação* (Soares, 2010).



In order to understand how Magda Soares specifically viewed this type of instruction, we will examine what she proposed in that book, where, in a tone resembling a teaching manual, she took on two "missions":

I- To present the *theoretical and methodological foundations of her proposal for the training of early reading and writing teachers*, and to propose to readers activities for study, observation, and reflection on "how children learn" in order to define "how to teach."

II- To present a clear *curriculum proposal* covering the entire "period of learning to read and write," based on the curricular goals she built and periodically revised with the collective of educators (teachers and teacher trainers) from Lagoa Santa, Minas Gerais, beginning in 2007.

Theoretical and methodological foundations for addressing the learning and teaching of the alphabetic writing system

Regarding the first point—the one that emerges from *Alfaletrar* as a "teaching manual" for the training of early reading and writing teachers—we see that, after situating *written language learning as a multilayered process*, discussing the *concepts of learning to read and write and literacy*, and establishing *text as the central axis of both*, the author invests heavily in examining the object we focus on in this article: the learning and teaching of the alphabetic writing system. In fact, she dedicates a greater number of pages in the book (from page 41 to 189) to the "linguistic facet"—that is, *learning to read and write (alfabetização)*—compared to those devoted to *literacy (letramento)* (from page 191 to 281). To better understand the importance Magda Soares places on the learning (and explicit teaching) of the alphabetic writing system, we will highlight two aspects: the *topics* she selected for in-depth treatment and the *tasks or reflective activities* she proposed to her readers.

At the outset of her 2020 work, Soares revisits the perspective she had already adopted in her 2016 book, *Alfabetização: a questão dos métodos* [Teaching to read and write: the question of methods]. She explains:

Learning to read and write is not the learning of a code, but the learning of a *system of representation*, in which signs (graphemes) represent, rather than encode, the sounds of speech (phonemes). Learning the alphabetic system is not about learning a *code*, memorizing letter*sound* relationships, but rather about understanding what writing *represents* and the notation by which, arbitrarily and conventionally, the sounds of speech—the phonemes—are represented (Soares, 2020a, p. 11, emphasis in the original).

In the set of "chapters" and "units" dedicated to the topic of the "alphabetic system," our author initially focuses on what she calls the "object of the process of learning to read and write"—the alphabetic writing system itself. She emphasizes that, in alphabetic



systems, children must dissociate the signifier and the meaning, and must focus on the oral signifiers of words (and their smaller sound units) in order to overcome "nominal realism," among other misconceptions (Soares, 2020a)⁷.

The psycholinguistic perspective that underpins the work embraces the evidence provided by the constructivist theory known as the *Psychogenesis of Written Language*, thoroughly revisiting the stages proposed in 1979 by Emilia Ferreiro and Ana Teberosky. However, there are two aspects that distinguish Soares' approach.

On the one hand, as in her classic 2016 book, Soares assigns a fundamental role to phonological awareness skills in the evolution of children's writing conceptions, treating them as indispensable factors for developing and refining more advanced hypotheses about writing (syllabic, syllabic–alphabetic, and alphabetic stages). On the other hand, already in Unit 2 of the same section, she adopts a Vygotskian perspective, according to which teacher mediation, within the school context, must actively guide the learner's development.

Reflecting on the fact that the classroom context differs from research situations, Magda Soares proposes that diagnostic assessments of children's levels of knowledge should serve as the basis for planning instruction that, systematically and intentionally, does not wait for boys and girls to "spontaneously discover" how the alphabetic notation system works. The emphasis on planning explicit and systematic instruction leads Soares, when discussing alphabetic writing, to introduce two themes to the reader that had not been investigated or carefully addressed by the theory of the *Psychogenesis of Written Language* or by some of its followers: the varying complexity of writing and reading different syllabic structures in a language like Portuguese, and the *regular conventions of reading and writing words* that learners must master in order to read and write autonomously.

As we have seen, these two themes had already received special attention from the author in her award-winning 2016 publication. We should also recall that two years earlier, Monteiro and Soares (2014) published an article analyzing evidence of the effect of the complexity of syllabic structures on the reading performance of children learning to read and write. The authors concluded that "[...] the educational implication is that explicit and systematic teaching of letter–sound correspondences and syllabic structures is necessary in early reading and writing activities that explore the word and the syllable as units of children's analysis" (Monteiro; Soares, 2014, p. 463).

What do we observe when analyzing the various activities that Magda Soares proposes in *Alfaletrar* to help readers appropriate the theoretical foundations related to the alphabetic writing system presented there? With the rare didactic precision characteristic of someone who, since the 1960s, had been producing pioneering educational materials, the author, in each unit of each chapter, challenges the reader-teacher to analyze and assess children's written productions, tasks proposed by teachers, excerpts from real classroom situations, and so on. Sections titled "*Pare e Pense*" [Stop and Think], "*Para*

⁷⁻ Unfortunately, many advocates of an approach to learning to read and write that prioritizes texts and discourse in Brazil still resist acknowledging the fact that, in order to learn the alphabetic notation system, children must reason about isolated written and spoken words, develop phonological awareness, and so forth.



saber mais" [To Learn More], "*Na Sala de Aula*" [In the Classroom], and "*Na internet*" [On the Internet] present a constant challenge in each chapter, encouraging readers to engage with real-world examples and situations—certainly collected by the author over her many years of advising public literacy networks in Minas Gerais, as was the case in Lagoa Santa.

The curriculum proposal for teaching the alphabetic writing system developed in Lagoa Santa, Minas Gerais, and the explicit teaching of alphabetic writing *reinvented there*

We reiterate that the curriculum presented by Soares in *Alfaletrar* for teaching reading and writing and literacy during preschool and across the first, second, and third grades of the early literacy cycle is a synthesis of the various curriculum proposals she developed and continually revised with the collective of educators from Lagoa Santa, Minas Gerais, between 2007 and 2020.⁸

In a country where many of her peers working in universities and schools of education are averse to the formal establishment of curricula (whether municipal, state, or national), Magda Soares believed that it is not possible to achieve the republican ideal of democratizing quality education without having pre-defined teaching goals (Soares, 2020b). Such goals, yes—very detailed goals—to guide the diagnosis of learners' knowledge and, from there, to plan instruction tailored as closely as possible to the real needs of the children. However, these goals should be defined and redefined collectively, democratically, and revised or updated based on the reality of the school context, indicating what kinds of adjustments need to be made.

Focusing specifically on our object of interest—the alphabetic writing system and considering that its learning and explicit teaching begin at the end of preschool, when the "period of learning to read and write" starts, Magda Soares proposed very clear learning goals for groups of four- and five-year-old children (Morais; Silva, 2023). These goals involve instruction that systematically promotes the development of phonological awareness skills and letter knowledge, alongside the spontaneous writing of words. The aim is not to formally teach letter–sound correspondences at this stage, but rather to help children move toward more advanced hypotheses about writing (at least to syllabic levels with phonetic value), while also beginning to learn certain conventional features of the alphabetic writing system (such as the directionality of writing, the names of the letters of the alphabet, and the phonetic values of some familiar letters) (Soares, 2020a).

Regarding the first, second, and third grades of elementary school, the teaching goals adopted since 2008 (Lagoa Santa, 2008) and updated on various occasions are presented by Soares (2020a) in *Alfaletrar* in fields labeled "Knowledge of Letters and the Alphabet," "Phonological Awareness," "Phonemic Awareness," "Word Writing," "Word Reading," and "Spelling Conventions." When we look at the expectations set out, for example, for

⁸⁻ The first official version was established in 2008, followed by updates every two years. The 2020 version closely resembles what Magda Soares presents in Alfaletrar, although small adjustments were made. After the publication of this book, a new update was produced in 2022 (Lagoa Santa, 2022).

word writing and reading, we find specific goals for mastering orthographic issues each year (such as the use of *QU*, *GU*, *R*, and *RR*, in Portuguese language) and for learning syllables with varied structures (CV [Consonant–Vowel], CCV [Consonant–Consonant–Vowel], CVC [Consonant–Vowel–Consonant], and oral and nasal vowels, among others). It is not expected that children will simply "discover (or fail to discover) on their own" the complex relationships between graphemes and phonemes after they have reached an alphabetic hypothesis and begun to write with some degree of conventionality. Rather, it is assumed that it is the task of a school network to establish goals, to diagnose, and to plan explicit teaching to achieve those goals. In *Alfaletrar*, to support such actions, Soares (2020a) discusses in detail topics such as "representation of nasality," "context-dependent regular correspondences," and the eleven distinct "syllabic structures of Portuguese."

Such instruction involves creating playful didactic tools, such as the "Tiny houses game" or "Where do the phonemes live?" (Soares, 2020a), in which children explore and systematize their learning of grapheme–phoneme correspondences in syllables with different structures, without being subjected to "drills on syllabic families," "pronunciation of isolated phonemes," or "copying isolated letters." According to the author, this game "[...] is an alternative for systematizing grapheme–phoneme and phoneme–grapheme correspondences, making them explicit in a two-dimensional chart into which syllables from words suggested by various activities are progressively inserted" (Soares, 2020a, p. 130).

One might question whether the expectations expressed through the goals mentioned above are "too high," considering what we are accustomed to seeing in many publicschool classrooms and what research reveals about the learning of reading and writing in the early grades of elementary education in Brazil. To answer this question, we must remember, first, that the curriculum developed in Lagoa Santa promotes the beginning of the learning-to-read-and-write process during early childhood education—not through systematic or explicit teaching of grapheme–phoneme correspondences, but intentionally aiming to help children advance in the appropriation of the alphabetic writing system. Second, we must recall that this curriculum is guided by diagnostic assessments applied to all children, in all classes, from ages four to eight, three times per year—importantly, assessments that are formulated, applied, and analyzed by the educators themselves within the school system, under the guiding principle of ensuring "progression" and 'continuity" in collective learning.

It is important to highlight, then, that the "network assessments" conducted in the Lagoa Santa schools—which Magda Soares and the entire team chose to call "diagnostics"—include in their frameworks, for each grade of the early literacy cycle, specific descriptors for "word reading" and "word writing." In other words, while never abandoning the broader scope of literacy, there is a continuous focus on verifying, for example, whether, by the end of the school year, each first-grade child "writes words with CVC syllable structures" and "reads words formed by standard CV syllables" (Soares, 2020a, p. 317).

We emphasize: such detailed attention coexists, within the same assessment matrix, with carefully selected descriptors to evaluate skills and knowledge related to "text reading and interpretation." Thus, in the first year, from the broader set of goals outlined for this instructional area (Soares, 2020a), specific skills are selected for census-based assessment,



such as the abilities to "locate explicit information" and to "identify substitutions and anaphoras" in texts (Soares, 2020a, p. 317).

Magda Soares' positions regarding the proposals of the BNCC, the Phonics Method, and the PNA for the teaching of the alphabetic writing system

Since the 1980s, Magda Soares consistently embraced her role as a "citizen specialist" committed to contributing to debates and the shaping of education policies related to Portuguese language teaching and early reading and writing instruction (Soares, 1991). She took part, for instance, in the first edition of the *Programa Nacional do Livro Didático* (PNLD) [National Textbook Program], where she served as the coordinator for the analysis of early reading primers (Maciel; Rocha, 2023). According to Maciel and Rocha (2023, p. 285):

This catalog became emblematic and controversial within the field of early reading and writing instruction in Brazil, especially regarding the few textbooks approved for public schools, as many primers were rejected. This moment marked the beginning of new perspectives for the production of reading and writing instruction textbooks, emphasizing the use of authentic texts and exercises that did not focus on visuo-motor training or pseudo-texts for teaching reading and writing.

In recent years, her stance remained unchanged. Regarding the BNCC, her criticisms of the curriculum's failure to include the initiation of explicit instruction in alphabetic writing at the end of early childhood education are well known. As she expressed in a public report on the third version of the document in 2017, Magda Soares pointed out that

[...] there are skills and knowledge that can and should be systematically and explicitly taught at this stage, with full capacity for children to learn and develop them (remember, these are 21st-century children, regardless of their social background), and it is regrettable that this learning and development are postponed to the early grades of elementary school, in a way interrupting a natural process of child development and learning (Soares, 2017, p. 5).

In the same report, Magda Soares advocated for the inclusion, within the field of experience then called "Language and Imagination," of learning objectives related to the initial appropriation of the alphabetic writing system. Such objectives, she argued, could and should have been part of the early childhood curriculum, including tracing, knowing, and recognizing the letters of the alphabet; identifying frequently used stable words; distinguishing drawings from writing; identifying the conventional directionality and orientation of writing; and understanding that writing represents the sounds of words, not their meanings.

Regarding the phonics method, while in *Alfabetização: a questão dos métodos* [Teaching to read and write: the question of methods] Magda Soares did not directly criticize this synthetic method (nor the syllabic method), choosing instead to advocate that we should "teach reading and writing with a method, not with a single method" (Soares, 2016), in the following years her critiques became clearer and more direct. In *Alfaletrar*, when addressing phonemic awareness, she reiterates that

[...] phonemes are not directly observable, nor are they pronounceable in isolation. Therefore, phonemic awareness does not develop spontaneously, and it is unreasonable to expect children to recognize, manipulate, or pronounce phonemes. To appropriate the invention [the alphabetic writing system], the child needs to perceive the phonemes that the letters represent, not to pronounce them, since they are unpronounceable (Soares, 2020a, p. 121, emphasis in the original).

In the same chapter, the author had already made the following critique:

There are proposals for the initial teaching of the alphabetic writing system in which what we consider here as the *point of arrival* is taken as the *starting point*: reading and writing instruction would begin with the direct teaching of the association between letters and their sounds, leading to the learning of a *code* that must be *memorized*, rather than the learning of a *system of representation*, which is gradually *understood* through stages that start with the comprehension of the word as a sound chain and guide the child toward understanding the letter as the representation of the smallest sounds in that chain (Soares, 2020a, p. 113, emphasis in the original).

After the Ministry of Education in 2019 sought to impose the phonics method nationwide through the highly authoritarian National Literacy Policy (PNA)⁹, the blatant disregard for the broader community of educators and specialists in this field was forcefully rejected by Magda Soares. In one of her last interviews, she stated explicitly:

It is unacceptable that those who defend the phonics method as the only one based on "scientific evidence" should reduce this evidence solely to research on the results of applying this method, without comparing it to the outcomes of other methods, and while ignoring scientific evidence from the fields of Linguistics, particularly Phonetics and Phonology. Scientific evidence shows that in the sound chains that constitute words, the sounds of phonemes are completely fused with one another within syllables, are not physically separable from the speech stream, and cannot be pronounced in isolation; therefore, from a scientific standpoint, it is not legitimate to expect individuals to pronounce phonemes in order to associate them with letters (Soares, 2022, p. 18).

Already at the beginning of the current millennium, Magda Soares had expressed her concern about the reemergence of the phonics method as a supposed solution for the "reinvention of teaching/learning to read and write," a movement that was taking shape systematically at that time in Brazil. In the article *Letramento e alfabetização: as muitas facetas* (Soares, 2004a) [Literacy and learning to read and write: the many facets], she warned that this reinvention could not represent a regression to earlier paradigms,

⁹⁻ This refers to Decree no. 9,765 of April 11, 2019 (Brasil, 2019).



undoing the advances and achievements gained over recent decades in the field of early reading and writing instruction.

In short, Magda Soares strongly rejected both the omission by the BNCC regarding the initial learning of the alphabetic writing system in early childhood education and the imposition of the phonics method by the PNA, which, at the other extreme, established phonemic training as a necessary condition for children to learn to read and write. When Professor Magda Soares passed away, on the symbolic date of January 1, 2023, new winds fortunately began to blow in a direction contrary to the setbacks she had so vehemently criticized during her lifetime. It remains for us to draw inspiration from her positions, which will endure as part of her invaluable legacy to the field of early reading and writing instruction in Brazil.

Final considerations

As we have sought to demonstrate, Magda Soares was concerned from early on with the risks of neglecting explicit instruction in the alphabetic writing system—or, in her words, of "de-inventing reading and writing instruction." In the most comprehensive and careful review of the available literature on the topic in Brazil (Soares, 2016), she proposed that, to teach alphabetic writing, we must understand how children learn this specific object of knowledge—one that includes not only the comprehension of the alphabetic writing system and mastery of sound–grapheme correspondences, but also the automatization of the various syllabic structures of the language and the appropriation of spelling regularities (and the irregularities that children frequently encounter).

Clearly, this requires a specific foundation, which cannot be provided solely by linguistic theories focused on discourse or text—no matter how much we may admire certain theoretical icons. To address an object of knowledge such as alphabetic notation, Magda Soares shows us that, beyond phonological foundations, we must draw upon psycholinguistic theories and studies that approach the core of the matter: how children advance in exploring oral and written words and their internal parts. No other path or theoretical perspective allows us to fully explain the process of appropriating our writing system.

Shortly before her passing, in the aforementioned interview with Ana Ruth Moresco in 2022, Magda Soares revealed that she was working on a new book:

Thus, I am now writing what can be considered a second *Alfaletrar*, this time focusing on *literacy* (*letramento/letrar*), whereas the current one focuses on *learning to read and write* (*alfabetização/alfa*). My experience in public schools and my interaction with early childhood and elementary school teachers have highlighted the difficulty of, beyond teaching children to read and write, developing their reading and text interpretation skills (Soares, 2022, p. 20, emphasis in the original).

Surely, this new work would have further grounded us in the realities of school practice, offering a more realistic discussion about how to promote the skills related to literacy in the domain of reading and text comprehension. After all, since the end of the last millennium, Magda Soares had already taught us that the schooling of reading and



literature is an inevitable process-and that it is important for it to be well conducted (Soares, 1999).

We conclude by emphasizing that although Magda Soares was a pioneer in defending *literacy* (*letramento*) as a foundational and non-negotiable perspective within the learning-to-read-and-write process, she never "rendered invisible" the teaching and learning of written notation as another equally foundational facet of this process. On the contrary, she consistently treated it as a republican obligation of schools, something to be pursued from the final grades of early childhood education onward.

References

BRASIL. Decreto nº 9.765, de 11 de abril de 2019. Institui a Política Nacional de Alfabetização. **Diário Oficial da União**, Brasília, DF, seção 1, n. 70-A, p. 15-17, 11 abr. 2019.

EHRI, Linnea Carlson. Aquisição da habilidade de leitura de palabras e sua influência na pronuncia e na aprendizagem do vocabulario. *In*: MALUF, Maria R.; CARDOSO-MARTINS, Cláudia Cardoso (org.). **Alfabetização no século XXI:** como se aprende a ler e a escrever. Porto Alegre: Penso, 2013. p. 49-81.

FERREIRO, Emilia; TEBEROSKY, Ana. Los sistemas de escritura en el desarollo del niño. Ciudad de México: Siglo XXI, 1979.

GERALDI, João Wanderley. O texto na sala de aula. Cascavel: Assoeste, 1984.

LAGOA SANTA. Secretaria Municipal de Educação. **Projeto Alfaletrar**: metas em progressão. Lagoa Santa: Secretaria Municipal de Educação, 2008.

LAGOA SANTA. Secretaria Municipal de Educação. **Projeto Alfaletrar**: metas em progressão. Lagoa Santa: Secretaria Municipal de Educação, 2022.

MACIEL, Francisca Izabel Pereira; ROCHA, Juliano Guerra. Magda Soares e sua produção intelectual no campo da alfabetização, leitura e escrita no Brasil (1959-1998). **Revista Linhas**, Florianópolis, v. 24, n. 26, p. 280-306, 2023. https://doi.org/10.5965/1984723824562023280

MONTEIRO, Sara Mourão; SOARES, Magda. Processos cognitivos na leitura inicial: relação entre estratégias de reconhecimento de palavras e alfabetização. **Educação e Pesquisa**, São Paulo, v. 40, n. 2, p. 449-466, 2014. http://dx.doi.org/10.1590/S1517-97022014005000006

MORAIS, Artur Gomes de; SILVA, Alexsandro da. Alfabetização e letramento na educação infantil: o legado de Magda Soares. **Revista Brasileira de Alfabetização**, São Paulo, n. 20, p. 1-16, 7 set. 2023. https://doi.org/10.47249/rba2023768

SOARES, Magda Becker. Alfabetização: a questão dos métodos. São Paulo: Contexto, 2016.

SOARES, Magda Becker. **Alfabetização**: em busca de um método? Educação em Revista, Belo Horizonte, n. 12, p. 44-50, 1990.



SOARES, Magda Becker. Alfabetização e letramento. São Paulo: Contexto, 2003a.

SOARES, Magda Becker. Alfabetização e letramento: caminhos e descaminhos. **Revista Pátio**, Porto Alegre, n. 29, p. 19-22, 2004b.

SOARES, Magda Becker. Alfabetização e literatura. **Revista Educação:** Guia da Alfabetização, São Paulo, v. 2, p. 12-29, 2010.

SOARES, Magda Becker. **Alfaletrar:** toda criança pode aprender a ler e a escrever. São Paulo: Contexto, 2020a.

SOARES, Magda Becker. A escolarização da literatura infantil e juvenil. *In*: EVANGELISTA, Aracy Alves Martins; BRANDÃO, Heliana Maria Brina; MACHADO, Maria Zélia Versiani (org.). **A escolarização da leitura literária:** o jogo do livro infantil e juvenil. Belo Horizonte: Autêntica, 1999. p. 17-48.

SOARES, Magda Becker. A proposta de ensino e avaliação da alfabetização em Lagoa Santa, Minas Gerais: Entrevista com Magda Becker Soares. [Entrevista cedida a] Artur Gomes de Morais e Telma Ferraz Leal. **Em Aberto**, Brasília, DF, v. 33, p. 1-11, 2020b. https://doi.org/10.24109/emaberto.v33i108.4438

SOARES, Magda Becker. A reinvenção da alfabetização. **Presença Pedagógica**, Belo Horizonte, v. 9, n. 52, p. 15-21, jul./ago. 2003b.

SOARES, Magda Becker. As muitas facetas da alfabetização. **Cadernos de Pesquisa**, São Paulo, n. 52, p. 19-24, fev. 1985.

SOARES, Magda Becker. **Leitura crítica**: a etapa da educação infantil BNCC - 3ª versão. Brasília, DF: Ministério da Educação, 2017. Disponível em: http://basenacionalcomum.mec.gov.br/images/relatorios-analiticos/Parecer_2_Infantil_Magda_Becker_Soares.pdf. Acesso em: 20 jul. 2023.

SOARES, Magda Becker. Letramento e alfabetização: as muitas facetas. **Revista Brasileira de Educação**, Rio de Janeiro, n. 25, p. 5-17, 2004a. https://doi.org/10.1590/S1413-24782004000100002

SOARES, Magda Becker. Letramento: um tema em três gêneros. Belo Horizonte: Autêntica, 1998.

SOARES, Magda Becker. Linguagem e escola: uma perspectiva social. São Paulo: Ática, 1986.

SOARES, Magda Becker. Magda Soares em entrevista para Cadernos de Educação (UFPel). [Entrevista cedida a] Ana Ruth Moresco Miranda. **Cadernos de Educação**, Pelotas, n. 66, p. 1-20, 2022. https://doi. org/10.15210/educacao.v66i.2174

SOARES, Magda Becker. Metamemória-memórias: travessia de uma educadora. São Paulo: Cortez, 1991.

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