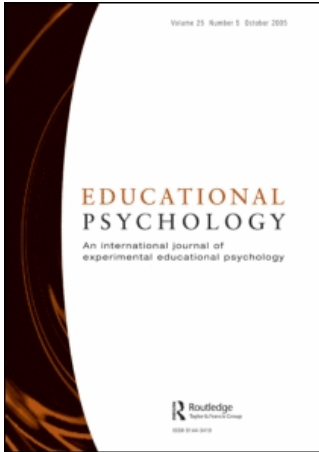


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## *Relations Between Children's Invented Spelling and the Development of Phonological Awareness*

**C. SILVA & M. ALVES MARTINS**, *Instituto Superior de Psicologia Aplicada, Portugal*

**ABSTRACT** *The objective of this study was to assess the impact on phonological skills of a training program that was intended to lead preschool children to move from prephonetic spellings to early phonemic spellings. The participants were 30 preschool children who were divided into two groups (experimental and control groups) that were equivalent in terms of the children's intelligence, the number of letters with which they were familiar and the nature of their invented spelling. The intervention proved effective, inasmuch as the children in the experimental group moved to early phonemic spellings, whereas those in the control group did not. This conceptual evolution entailed enhanced performance in phonemic classification, segmentation and deletion tests, in which the children in the experimental group displayed a degree of progress which differed significantly from that achieved by the members of the control group.*

### **Introduction**

Interest in studying children's attempts at writing prior to formal education really began to develop in the 1970s. A large number of works (Alves Martins, 1994, 1996; Alves Martins & Quintas Mendes, 1987; Besse, 1993, 1995, 1996; Chauveau & Rogovas-Chauveau, 1994; Ferreiro, 1988; Ferreiro & Teberosky, 1986; Pontecorvo & Orsolini, 1996; Pontecorvo & Zuchermaglio, 1988, 1995; Read, 1971, 1975, 1986; Sulzby, 1989; Tolchinsky, 1995; Tolchinsky & Levin, 1988) have shown that an understanding of the nature of the alphabetic systems of writing is a process that begins early on, via the informal contacts that children make with written language. In their efforts to understand the meanings of graphic marks, and via interaction with others, children gradually ask themselves questions about the relationships between objects and writing and between oral and written forms of language. In this way they build up unconven-

tional ideas about the properties of writing and what it represents. They construct a series of conceptual hypotheses that can be more or less close to the real alphabetic system.

Ferreiro (1988) analysed the invented spelling of children who had not yet received any formal teaching in reading and writing. The results of her research led to the conclusion that children's knowledge about written language evolves along a path with three essential levels of conceptualisation.

The first of these levels can be characterised by the search for criteria that make it possible to differentiate between drawings and writing. Alongside this differentiation the child also works out criteria that make a series of letters capable of transmitting a message. These criteria are the minimum quantity of letters needed to write and to read a word and the fact that one does not employ the same sequence of letters in different words.

The second level involves a refining of the ways in which both qualitative (the diversification of the orders of known letters in children's attempts to write) and quantitative (the minimum number of letters required to make it possible to interpret writing) differentiation between chains of letters are achieved. This is necessary in order to ensure differences between the ways in which different words are represented.

At these levels in their attempts at writing, children don't search for any correspondence between oral and written language and often spell words according to the size of the reference items—for example, by using more letters for words that refer to large items.

On the third level children begin to relate oral to written language. This level begins with the search for equivalencies between letter elements and syllabic segments in words (the syllabic hypothesis). Via this type of relationship children begin to solve the problem of the correspondence between the whole of the word and its constituent parts. This conceptual level culminates in an understanding of the alphabetic nature of written language, preceded by an intermediate phase involving syllabic-alphabetic spellings, in which some of the phonemes in each word are not yet represented. One important aspect that is worthy of note is that when it comes to children who spell in accordance with the syllabic hypothesis, Ferreiro (1988) does not differentiate between those who establish the letter/syllable equivalence on a purely random basis and those who choose conventional letters with which to represent one of the sounds in a syllable.

Other authors (Alves Martins, 1994; Besse, 1995) consider that these two ways of approaching writing reflect different levels of knowledge. In reality it is probable that phonemic spellings, even at a syllabic level, imply a strategic mobilisation of knowledge concerning letter names, and as such entails an embryonic form of insight into the way in which the linear organisation of the sounds in a word corresponds to the spatial sequence of the letters therein. This type of phonemic spelling thus reflects a number of advances in relation to a syllabic conception of writing in which children do not establish a conventional equivalence between the letters in and the sounds of a given syllable.

Various authors (Pontecorvo & Orsolini, 1996; Ferreiro, 1991; Vernon, 1998) consider that children begin to analyse the phonological components of words during the course of their pre-conventional writing. They emphasise that access to the phonemic structure of words can only be acquired either via attempts at writing or by means of formal teaching. For example, Ferreiro (1991) points out that "children become

aware of some of the properties of a sound sequence as a means of dealing with the formal problem they come up against when writing” (p. 170).

Bearing in mind the many research projects that have established a relationship between children’s awareness that words can be broken down into various separate sound segments and their subsequent success in learning to read (Goswami & Bryant, 1990; Perfetti, Beck, Bell, & Hugues, 1987; Wagner & Torgesen, 1987), the suggestion we set out herein is that children’s invented spelling prior to formal education may constitute a way of developing phonological awareness, and consequently favour the acquisition of literacy.

A similar point of view is shared by several authors (Mann, 1993; Richgels, 1995; Treiman, 1998; Treiman & Cassar, 1997) who have investigated the relationship between phonological awareness and learning to read, and who began to analyse the invented spelling of preschool children in the 1990s.

Treiman (1998), for example, argues that preschool children’s invented spelling (such as “BT” for “beat”) is a way of fostering their phonemic awareness and modelling their conception of phonemic entities, while simultaneously constituting an indicator of their phonemic abilities. Invented spelling would thus be of value when it comes to predicting a child’s success in learning to read, and indeed this has been corroborated by various studies (Mann, 1993; Richgels, 1995; Vale & Cary, 1998). Treiman also considers that children’s invented spelling may facilitate their acquisition of insights into the alphabetic structure of writing.

Adams (1998) takes a similar stance when he says that, “the evidence that invented spelling activity simultaneously develops phonemic awareness and promotes understanding of the alphabetic principle is extremely promising, especially in view of the difficulty with which children are found to acquire these insights through other methods of teaching.” (p. 387).

So the role that writing activities, including interactions around children’s attempts at writing, may play as a factor facilitating educational success in learning to read may be examined in a number of different ways.

Inasmuch as understanding the alphabetic principle implies coordinating phonemic awareness with a familiarity with letter names and an understanding of their notational function in writing (Byrne & Fielding-Barnsley, 1990), and given that there seems to be a reciprocal development relationship between phonemic awareness and children’s pre-conventional writing, preschool children’s involvement in invented writing activities may have positive consequences when they come to learn to read.

This hypothesis appears plausible, at least from the moment at which children begin to produce phonemic spellings—that is to say, when they start using some conventional letters to represent some of the sounds in words. To the extent that letters constitute a concrete support for the representation of phonemes (Alvarado, 1998; Stahl & Murray, 1998), attempts at writing which reflect the perception that writing effectively codes segments of oral language, and in which a child begins to play with letter–sound relationships, may facilitate the development of phonemic awareness. Stahl and Murray (1998) have shown that knowledge of letters seems to be a necessary, albeit insufficient, condition for children to be able to manipulate intrasyllabic units and to construct phonemic identity (in other words, to be able to recognise identical phonemes in different words). In turn, the latter phonological ability is particularly important if children are to manage to latch onto the alphabetic structure of writing (Byrne, 1998; Murray, 1998).

The idea that invented spelling and informal exploration of the written code may foster the development of phonological abilities may equally be confirmed by research conducted by Lomax and McGee (1987), who tested a multidimensional model for the literacy acquisition process. They evaluated children aged three, four, five and six for performance in a set of literacy-related measures and assessed the relationships between the latter. Their results reveal that a set of factors, which they group together under the term "graphic awareness" and which concern children's knowledge about the orientation of letters and their ability to discriminate between letters and between words, manage to explain 99% of the variance between the results that children achieve in a number of phonemic tasks.

Two recent studies (Alvarado, 1998; Vernon, 1998) reveal the existence of a relationship between the quality of preschool children's invented spelling and their performance in phonological tasks. For example, in her study Alvarado (1998) suggests that there are significant differences between the results children achieve in an initial phoneme deletion task, depending on whether their spelling is characteristically pre-phonetic, early phonemic or alphabetic. Another interesting aspect of this study is the fact that children systematically obtained better results in the deletion task when it was accompanied by a written support than when it was carried out in an exclusively oral mode. A comparison between children who regulate their spelling using the syllabic hypothesis, both with and without representing different syllables by conventional letters, suggests the importance of the use of conventional letters as a factor to stimulate phonemic awareness. The phonemic group achieved success rates of 57% and 8% in a phonemic test, with and without a written version respectively. Children who wrote syllabically without employing phonetic procedures were substantially less successful, attaining rates of 15% and 7% in the same situations.

Similarly, Vernon (1998) showed that children at a less evolved conceptual level offer less analytical responses to a word segmentation task than do their more advanced peers. This study also confirms that when words are presented using a written support, children are better at segmenting than when the same words are only presented orally.

In summary, various sets of evidence and authors sustain the theory that children's invented spelling may constitute a tool that potentially helps to promote both phonological awareness (and especially phonemic awareness) and an understanding of the alphabetic properties of language, above all from the time when children start to be concerned to use conventional letters to represent some of the sounds in words. However, given the multidimensional nature of phonological skills (Goswami, 1998; Stahl & Murray, 1998), it seems to us that the current research would benefit from a more in-depth look at the effect that phonemic procedures which are used in spelling may have on phonological awareness, using a set of measures that represent phonological abilities at different levels of difficulty.

The fact is that phonological abilities are now seen as a continuum (Stanovich, 1992) in which skills such as the detection and production of rhymes are on a lower level (because they require few analytical abilities and just a feeling for similar phonological sequences), while the abilities to segment and invert phonemes in words are on a higher level (inasmuch as they require an analytical attitude and an explicit representation of phonetic segments). It is against the background of this multidimensional perspective on phonological abilities that it seems to us to be important to analyse the consequences that phonemic procedures in children's prealphabetic spellings may have in on the various different levels of phonological awareness. This is the issue that we shall analyse in the light of the empirical study presented herein.

*Hypothesis*

We formulated the following hypothesis: when children with prephonetic spellings undergo a training program intended to induce them to move to early phonemic spellings, their phonological skills (assessed using a battery of phonological tests) evolve faster in comparison with those of children who have not received any form of training.

**Method***Participants*

Participants were 30 Portuguese children with an average age of 5 years 6 months (standard deviation 3 months), a minimum age of 5 years 1 month and a maximum age of 5 years 11 months. They attended various different kindergartens and had received no formal teaching about reading and writing.

None of the children knew how to read—a fact that was verified in individual reading tests. Only children whose invented spellings in the pretest were prephonetic were chosen to take part in the study. They were randomly divided up into the experimental group and the control group.

*Experimental Design*

This was an experimental study in which children were subjected to a pretest and a posttest intended to evaluate their invented spelling and their phonological skills. Between the two tests the experimental group underwent a training program designed to induce a restructuring of their spelling, while the control group did some drawings.

Bearing in mind that a knowledge of letters may serve as an intermediary and facilitating instrument when it comes to achieving an awareness of phonemic entities (Stahl & Murray, 1998; Treiman & Cassar, 1997), the number of letters with which the children were familiar was checked. So was the level of their intelligence.

*Tasks and Procedure*

*The Evaluation of Children's Invented Spelling.* In order to assess the children's invented spelling, we asked them to spell their name and then to spell a set of words to the best of their ability. After spelling each word they were asked to read what they had spelled. The verbal utterings that frequently accompanied the act of spelling were recorded.

The words we dictated were organised as follows:

- words that are of an identical size from a linguistic point of view, but which refer to items that possess different sizes—for example: *urso/rato* (bear/rat)
- words that are of a different size from a linguistic perspective, but which refer to items of a similar size—for example: *hipopótamo/boi* (hippopotamus/ox)
- words that belong to the same family, are close in linguistic terms and belong to the same semantic area—for example: *lua/luar* (moon/moonlight)
- singular/plural pairs of words
- words beginning with different vowels and consonants

We employed the following two categories to classify the children's spellings: prephonetic spellings and early phonemic spellings. Prephonetic spellings were spellings of a syllabic type, in which the correspondence between oral and written language is based

on syllabic units. Before they spell, children often syllabically segment what is said to them orally and then represent each syllable using a random letter. Written words are read in syllabic fashion. Early phonemic spelling denotes spelling in which children analyse the spoken word in order to select a letter from those in their repertoire which adequately represents the sound they identify. Words often continue to be read syllabically and in their verbal output before they write anything, children try to identify not only the quantity of letters that they ought to use, but also—in some cases—the most suitable ones.

When we analysed the protocols we calculated the number of words that fitted into each of these categories. On the basis of this analysis we determined the percentile distribution of the various types of spelling between protocols and classified the children by evolutionary level. For a child to qualify for a given level, around 90% of his/her spelling had to match the applicable criteria.

*Evaluation of Children's Phonological Awareness.* In order to evaluate the children's phonological awareness we set them a battery of phonological tests composed of three subtests with varying levels of difficulty, to address the heterogeneous nature of this particular ability. When we created this battery of tests we sought to take account of the phonological properties of the initial phonemes in each of the words.

The battery included a classification test, a deletion test and a phonemic analysis test.

The initial phoneme classification test was composed of 14 items preceded by two training items. Each item consisted of four words, presented to the children in a figurative format. Two of the words began with the same phoneme and the other ones began with different phonemes. The children were asked to identify them—for example: fivela (buckle)/telhado (roof)/gaivota (seagull)/fogueira (bonfire).

In the initial phoneme deletion test the children were asked to pronounce in isolation each of the phonemes in words that were presented to them in a figurative format, and to say what remained of the word without the initial segment (the deletion of which resulted in something that was not a word in the Portuguese language). The test was made up of 24 items preceded by two training items, half of which were composed of monosyllabic words and the remainder of disyllabic words. The phoneme that had to be deleted always coincided with the onset of the syllable—for example: r/i/o; io.

In the phonemic analysis test the children were asked to pronounce in isolation each of the phonemes in words that were presented to them in figurative form. Each word contained between two and four phonemes. The test was made up of 14 items, again preceded by two training items that modelled the division of two words into their phonemic segments.

In all the tests one point was awarded for each correct answer.

*Evaluation of children's knowledge of letters.* In order to determine how many and which letters the children were familiar with, they were given a set of cards bearing the letters of the alphabet in capitals (K, W and Y were excluded as they are not formally part of the Portuguese alphabet), which they were asked to name. They were then asked to write down the letters they had recognised. The total possible score in this test was thus 23.

*Evaluation of children's intelligence.* The level of the children's intelligence was evaluated using the coloured version of Raven's Progressive Matrices test (Raven, Raven &

Count, 1998). *The Training Program*. The training was organised around situations that led the child to think about the rules of spelling from two points of view: his/hers, and that of a hypothetical boy/girl of the same age who spelled the words using some conventional letters to adequately represent some sounds.

The objective of these sessions was to lead children to move from prephonetic spellings to early phonemic spellings.

The list of the words to be written varied from child to child, depending on the letters with which each was familiar. The general format commenced with two initial sessions using words beginning with vowels. After that, each session involved spelling words that began with the same consonant. In the latter cases the first syllable in the first word coincided with a letter name, so as to facilitate the use of that letter—for example *rede* (net) or *rena* (reindeer) in which the syllable “re” coincides with the name of the letter R/re; *mesa* (table) or *Mena* (child’s name) in which the syllable “me” coincides with the name of the letter M/me/ (Alves Martins & Silva, 1999; Mann, 1993). Subsequent words might contain one or two syllables, and then later still, three. Besides this, and whenever possible given the limited range of letters with which the children were familiar, we sought to ensure that some of the words partially shared identical sound sequences—for example *ver* (to see), *verde* (green), *véu* (veil), *vi* (I saw), *vila* (town), *vela* (candle), *vale* (valley or is worth), *viola* (guitar or viola), *vitelo* (male calf), *vaso* (vase). As often as we could we also tried to use words in which the graphic–phonetic equivalencies were as simple as possible.

After spelling each word in whatever way they thought best, the children were shown one spelled by a hypothetical child of the same age who used a phonetically suitable letter with which to represent one of the sounds in each of the syllables of the word. In the face of this they were then asked to say which of the two they thought best. Before deciding, they had to slowly read both what they had written and the hypothetical child’s word, and to name the letters that each of them had employed to spell that specific word. They then had to try to justify why they had spelled the word in their way and why the other child had spelled it differently.

From the second session onwards the children were told to think of the letters that went best with the sounds of each of the words they spelled.

The children in the control group did two drawings per session.

The programs in the experimental and control groups involved eight sessions that lasted approximately 15 minutes each and were individually conducted by us with the children over the course of a fortnight.

## Results

We carried out *t*-tests on the data concerning the knowledge of letters and the level of intelligence of the children in the two groups. The results confirm the absence of any significant differences between the two groups, either for Raven’s Progressive Matrices ( $t(28) = 0.233$ ;  $P = 0.818$ ), or for the number of letters known ( $t(28) = 1.331$ ;  $P = 0.194$ ).

Table I shows the effect that the experimental training program had on the way in which the children approached written language. All the children in the experimental group produced phonemic spellings in the posttest, whereas only two children in the control group did so. The spelling of the other 13 children in the control group continued to be prephonetic and guided by syllabic criteria. We may thus conclude that



TABLE I. Number of children who produced prephonetic spellings and early phonemic spellings in the posttest

|                                 | Prephonetic spellings | Early phonemic spellings |
|---------------------------------|-----------------------|--------------------------|
| Experimental group ( $n = 15$ ) | 0                     | 15                       |
| Control group ( $n = 15$ )      | 13                    | 2                        |

the intervention program proved effective in fostering the use of phonemic procedures in children's invented spelling.

We will now look at an example taken from children's protocols that illustrates the types of spelling which prevailed at pretest and posttest, beginning with some of the words that Afonso spelled during the pretest:

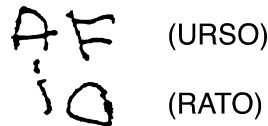

  
 AF (URSO)
   
 IO (RATO)

FIG. 1. Example of prephonetic spellings at the pre-test

Adult: Now spell "urso" (bear).

Afonso: Ur/so, there are two of them.... [spells "AF"].

Adult: Now read me what you have just written and show me with your finger.

Afonso: Ur [points to the A], so [points to the F].

Adult: Now spell "rato" (mouse).

Afonso: Ra [writes "I"] to [writes "O"].

Adult: Now read what you have just written to me again.

Afonso: Ra [points to the I] to [points to the O].

As we can see, in the pretest Afonso's spelling displays the typical characteristics of prephonetic spellings. This example reflects the type of spelling that predominated at the initial assessment among all the children who took part in this experiment, and contrasts with the way in which Afonso spelled at the post-test:


  
 US (URSO)
   
 RAO (RATO)

FIG. 2. Example of early phonemic spellings at the post-test.

TABLE II. Mean scores and standard deviations on the 14-item initial phoneme classification test

|                    | Pretest |      | Posttest |      |
|--------------------|---------|------|----------|------|
|                    | Mean    | SD   | Mean     | SD   |
| Experimental group | 6.33    | 2.84 | 10.66    | 2.43 |
| Control group      | 7.33    | 2.43 | 8.06     | 2.98 |

Adult: Now spell “urso”.

Afonso: Ur [writes “U”] so [writes “S”].

Adult: Now read me what you have just written and show me with your finger.

Afonso: Ur/so [points to the U and then to the S].

Adult: Now spell ‘rato’.

Afonso: Ra ... ra ... ra, it’s R [writes “R”], ra, ra, it’s A [writes “A”], ra/tu, tu is U [writes “U”].

Adult: Now read me what you have just written again and show me with your finger.

Afonso: Ra/to [points to the first two letters and then to the last one].

At the posttest, Afonso predominantly used early phonemic spellings. In some words—as when he wrote “rato”—it is possible to detect an analysis that goes beyond the syllable.

This program was designed to lead children to move from prephonetic spellings to early phonemic ones. We carried out a variance analysis using repeated measures to assess its impact on their phonological skills.

Taking the initial-phoneme classification test first, the descriptive statistics set out in Table II show that at pretest the control group’s performance was slightly better than that of the experimental group, whereas at posttest it was the experimental group that achieved superior results. ANOVA using the children’s results in this test as dependent variable and the two assessments and the experimental and control groups as independent variables, show that there is a significant assessment x group interaction, which means that the effect of the training differed from one group to the other [ $F(1,28) = 16.77, P = 0.000$ ]. On the other hand they show that the children’s results in this test evolve significantly between the two assessments [ $F(1,28) = 33.22, P = 0.003$ ].

The descriptive statistics for the initial phoneme deletion test (Table III) offer evidence of substantial progress between pretest and posttest in the experimental group—something that did not occur to the same extent in the control group. In effect, at pretest the control group’s performance was only slightly worse than that of the experimental group, but at posttest the experimental group returned average figures that were quite a lot higher than those of the control group.

ANOVA results using the children’s results in this test as dependent variable and the two assessments and the experimental and control groups as independent variables allow us to discern a significant effect produced by assessment x group

TABLE III. Mean scores and standard deviations on the 24-item initial phoneme deletion test

|                    | Pretest |      | Posttest |      |
|--------------------|---------|------|----------|------|
|                    | Mean    | SD   | Mean     | SD   |
| Experimental group | 6.33    | 4.82 | 14.46    | 7.16 |
| Control group      | 4.93    | 5.65 | 6.60     | 7.66 |

TABLE IV. Mean scores and standard deviations on the 14-item phonemic analysis test

|                    | Pretest |      | Posttest |      |
|--------------------|---------|------|----------|------|
|                    | Mean    | SD   | Mean     | SD   |
| Experimental group | 0.66    | 0.98 | 7.26     | 3.05 |
| Control group      | 1.06    | 1.38 | 1.26     | 2.43 |

[ $F(1,28) = 12.42, P = 0.001$ ] as well as a significant evolution between the two assessment [ $F(1,28) = 28.52, P = 0.000$ ]. It is thus possible to accept the existence of a significant evolution in the children's performance between pretest and posttest, and that this progress differed from one group to the other.

As regards the phonemic analysis test, the average results set out in Table IV indicate that the children from both groups achieved virtually identical—and particularly low—average scores in the pretest. At posttest the figures for the children from the experimental group had evolved quite considerably and were superior to those achieved by their fellows in the control group, which continued to reveal substantial shortcomings.

The ANOVA results using the children's results in this test as dependent variable and the two tests and the experimental and control groups as independent variables show that test  $\times$  group [ $F(1,28) = 82.71, P = 0.000$ ] has a significant effect as well the test variable [ $F(1,28) = 93.34, P = 0.000$ ] and the group variable [ $F(1,28) = 16.29, P = 0.000$ ]. In light of this it is possible to confirm both the existence of significant progress in the children's performance between pre-test and posttest, and that that progress differed between the two groups. We may consequently infer that it was the intervention program undergone by the experimental group that caused this significant evolution.

In summary we can state that the training that was given to the children led them to achieve significant improvements in their results in all the phonemic tests.

## Discussion

The experimental intervention conducted within the ambit of this study led children to understand that spoken words should be coded using specific letters to represent each segment's sound properties. It seems probable that this understanding in turn caused the children to realise that the same letter should be used to represent sounds that are

identical, whereas different sounds should be written using different letters. This conclusion is a clear consequence of an analysis of the children's protocols, in which in most cases the same letter is employed to represent the same sound in different words.

In light of our results, and of the characteristics of the experimental intervention itself (which principally entailed using letters with which the children were already familiar in order to spell certain words), it is possible to state that from an educational point of view this type of intervention lends added weight to the importance that many authors (Alves Martins, 1996; Chauveau & Rogovas-Chauveau, 1994) say written-language-related interventions possess, in relation to progress in children's knowledge of the way in which the written code is organised. The type of intervention we carried out is also in harmony with the same authors' suggestion that the starting point for such interventions should be children's own ideas, knowledge and points of view about written language.

The results which the experimental group children obtained in the phonemic tests at posttest suggest that it is possible to establish a causal link between early phonemic spellings on the one hand, and children's growing ability to latch onto the phonemic units in speech on the other.

These results also make it possible to justify the hypothesis that early phonemic spellings may represent one of the possible interfaces between the development of segmental awareness and an understanding of the way in which the alphabetic code works. Byrne's (1998) theories also lend consistency to this proposition. He argues that within children's perception of written language as a way of coding the phonological structure of words, it is the conjugation of phonemic awareness and the knowledge of letters that enables children to latch on conceptually to the alphabetic principle. Inasmuch as phonemic spellings promote segmental awareness (as our data shows) and probably cause children to feel the need to get to know more letters, they may well constitute a tool that facilitates this.

The experimental group's scores in the phonemic tests they took at posttest are in harmony with the argument put forward by a number of authors (Adams, 1998; Stahl & Murray, 1998; Treiman, 1998) that preconventional invented spelling favours the development of segmental analysis skills and fosters phonemic awareness. These authors' proposition is that the process whereby children search for the best letters with which to match the sounds of words fosters an analytical attitude towards the spoken word, in which the letters that are chosen serve as tangible intermediaries for an awareness of phonemic entities. Within this overall point of view Stahl and Murray (1998) consider that "the alphabet may also mediate the development of phonological awareness through children's invented spelling. As children move from prephonetic spellings ... to early phonemic spellings, where the children use the initial and sometimes the final consonant sounds to represent the whole word (b or br for "bear"), they are beginning to analyse the spoken word. Having a letter to represent that sound seems to be the beginning of the establishment of phonemic identity ...' (p.82).

Our data lend substantial support to the position taken by these authors, not least because the phonemic task in which the children performed best at posttest was the initial phoneme classification test, which may be considered to be an indicator of a child's awareness of phonemic identity.

Within this conceptual framework it also becomes possible to understand why it is that the quality of invented spelling prior to formal schooling is a better predictor of a child's success in learning to read than are measurements concerning phonemic awareness (Alves Martins, 1996; Mann, 1993; Vale & Cary, 1998).

At the same time our data partially agree with those produced by Alvarado (1998) and Vernon (1998). Alvarado's empirical research revealed the existence of major differences in the performance of an initial phoneme deletion task between children who write syllabically without conventional letter equivalence and those who write syllabically with such an equivalence. However, when the latter group performed this task on a solely oral basis their success rate was significantly lower than that which the children in our experimental group achieved at posttest.

There are two possible reasons for this discrepancy, the first of which is the phonological structure of the words used in the task. The type of words with which Alvarado (1998) recorded the greatest success used the same structure as that employed in our test, but she also resorted to words with a much more complex linguistic structure. Another reason that may have contributed to the higher success rate recorded by our children derives from the fact that they took the test at more or less the same time as they carried out the posttest spelling task, and in a sense were thus continuing to train for questions involving manipulation of the phonological structure of words.

Vernon's (1998) research shows that in a successive segmentation task, syllabic children who establish conventional letter/sound equivalencies answer more analytically than do their syllabic peers whose spellings are prephonetic.

Contrary to Vernon's (1998) research, in which phonemic analysis success rates were not very significant, and to a large body of research work which indicates that phonemic segmentation is directly correlated with children's progress in formally learning to read (Morais, Cary, Alegria, & Bertelson, 1979; Perfetti et al. 1987), the children in our experimental group achieved an average success rate of 51% in the phonemic analysis task at posttest. These results suggest that even early phonemic spellings have direct effects on children's ability to analyse the phonemic components of words, at least when it comes to words with a simple phonological structure.

The discrepancy between our data and that obtained by Vernon (1998) is probably due to the nature of the task involved, given that Vernon's children were not explicitly told to divide words into all their phonemes.

The differences between our results and those of the various studies which show that segmentation abilities can be correlated with the alphabetic code may in turn be derived from the variation that arises in the linguistic complexity of the words that are used in this kind of test. This factor may be particularly important as the linguistic complexity of the words used contributes more to the variance in children's scores in phonological tests than does the nature of the task itself (Stahl & Murray, 1994). In these research projects it is often the case that neither the linguistic structure of words, nor their size is controlled. For example, children's performance in relation to very long words may be contaminated by factors of a mnemonic nature (MacBride-Chang, 1995). These aspects can influence children's scores in phonemic segmentation tests and make a comparison between tasks conducted in different projects a very complicated prospect. In this respect it should be remembered that the items in our phonemic segmentation test did not include either very long words or words with complex syllabic structures. This probably explains why our children achieved better results than those in previous studies, which have indicated that in most cases phonemic segmentation is only attained once a child has already learned to read.

From a pedagogical point of view our results show the importance of early stimulation of invented spelling activities as a means of promoting both phonological awareness and the gradual learning of the alphabetic principle.

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