VISUAL DICTATION IMPROVES THE SPELLING PERFORMANCE OF THREE GROUPS OF DUTCH STUDENTS WITH SPELLING DISABILITIES

Janet G. van Hell, Anna M. T. Bosman, and Monique C. G. Bartelings

Abstract. A spelling training was implemented in three subgroups of Dutch children (N = 33) with spelling disabilities: (a) children with spelling problems of normal or above-normal intelligence; (b) children with spelling problems of normal or above-normal intelligence who also exhibited severe externalizing behavioral problems; and (c) children with spelling problems of relatively low intelligence. Two types of words were trained (N= 24): words with ambiguous sound-spelling relations and words with complex consonant clusters. The training was effective in all subgroups. The spelling performance on both types of words improved from pretest to posttest, and was on the whole sustained on the retention test. The only exceptions were the children with spelling problems and severe behavioral problems, whose performance on words with ambiguous sound-spelling relations dropped from posttest to the retention test, even though it remained above pretest levels. Theoretical and practical implications for the spelling instruction of subgroups of children with spelling problems on subclasses of words are discussed.

JANET G. VAN HELL, Department of Special Education, University of Nijmegen, The Netherlands.
ANNA M. T. BOSMAN, Department of Special Education, University of Nijmegen, The Netherlands.
MONIQUE C. G. BARTELINGS, Department of Special Education, University of Nijmegen, The Netherlands.

Mastering the intricacies of written language is a major challenge for beginning readers and spellers. In alphabetic languages, beginning readers and spellers must learn the relationships between phonemes (sounds) and graphemes (spellings). In some alphabetic languages, for example, Finnish and Spanish, these sound-spelling relations are rather predictable. That is, when presented with a phoneme a speller can almost always predict which grapheme is connected to the phoneme. Other alphabetic languages, like English, French, and Dutch, are highly inconsistent in terms of the sound-to-spelling relationship. As a result, when presented with a phoneme, a speller from these languages most likely has to choose from two or more possible graphemes. With regard to the connections from sound to spelling, Finnish and Spanish are shallow orthographies whereas English, French, and Dutch are deep orthographies. This distinction between *deep* and *shallow* is based upon the connections from sound to spelling rather than spelling to sound. With respect to its spelling-to-sound relationship, Dutch and French (Ziegler, Jacobs, & Stone, 1996) are relatively shallow, whereas English is deep (Stone, Vanhoy, & Van Orden, 1997). Generally, in most alphabetic orthographies

spelling is more difficult than reading because of the lower consistency from sound to spelling than from spelling to sound (Bosman & Van Orden, 1999).

Predictable sound-spelling relations refer to a one-to-one correspondence between phonemes and graphemes. For example, the Dutch phoneme [m] is almost always spelled M. More often, however, at least in Dutch and English, sound-spelling relations are ambiguous and unpredictable. For example, the Dutch phoneme [Ei] can be spelled with two graphemes "ij" and "ei," and the Dutch phoneme [Au] can be spelled with four graphemes "ou," "ouw," "au," or "auw." Given the difficulty of learning to read and spell, it is not surprising that some children have problems acquiring reasonable reading and spelling skills.

Teaching spelling skills to children with spelling disabilities is important for several reasons (cf. Fulk & Stormont-Spurgin, 1995; Graham, 1999). First, at least in literate societies, spelling skills are often conceived as an indicator of a person's linguistic or even intellectual abilities. As a result, children who make a relatively high number of spelling errors in their essays receive lower grades than children who make few errors, even when the overall quality of the essays is alike (Marshall & Powers, 1969, in Graham, 1999). Second, difficulties in finding the correct spelling for individual words may interfere with the pleasure to write (Berninger, Vaughan et al., 1998), thereby potentially constraining the development of higher-order writing skills involved in text writing, such as conceptualization and planning (Graham, 1999; MacArthur & Graham, 1987).

If untreated, spelling problems may persist throughout the elementary grades (e.g., Juel, 1988). Empirical studies indicate that children with spelling disabilities tend not to acquire spelling skills naturally through reading and writing (see Graham, 1999, 2000, for reviews; cf. Krashen, 1989). Rather than relying on a natural learning approach, children with spelling disabilities appear to need formal spelling instructions to attain spelling skills. This conclusion is substantiated by teachers' experiences that explicit spelling instruction is imperative to overcome spelling problems (e.g., Berninger, Vaughan, et al., 1998; for a review, see Fulk & Stormont-Spurgin, 1995).

In conclusion, developing and implementing effective spelling instruction for children with spelling disabilities is important. Although their spelling problems appear persistent, teaching spelling skills to these children is feasible, and instruction should preferably start at a relatively young age.

In the present article, we report on a spelling training program implemented with three subgroups of children with spelling disabilities attending different schools for special education. Additionally, the study examined the merits of the training for learning to spell different types of words; namely, phoneme-to-grapheme consistent and phoneme-to-grapheme inconsistent words. We will first outline the spelling training and its underlying assumptions regarding spelling cognition.

VISUAL-DICTATION TRAINING

In our spelling training, which we called visual dictation, children are visually presented with a word that they are told to study carefully. Next, the word is covered and they are asked to write the word in their notebook. The word is then shown again and the children check its spelling. In case of a misspelling, they correct their own writing and rewrite the word (while the word is visible).

In previous studies, we implemented a precursor of the visual-dictation training in a group of typically achieving spellers in first grade (Bosman & van Hell, 1999; van Leerdam, Bosman, & Van Orden, 1998). It comprised all the instructional elements described above but without a self-correction phase. The performance of the typically achieving students in the visual-dictation condition was compared with that of four groups of typically achieving spelling peers who followed one of four training procedures: (a) read each word aloud *(reading)*; (b) copied each word into a notebook (*copying*); (c) read each word aloud, after which the teacher covered the word, presented the target and a nontarget grapheme and asked the child to circle the correct grapheme (*grapheme selection*); and (d) read each word aloud and spelled each letter of the word from memory (*oral spelling*). All children were trained on the same series of words, each containing one targeted ambiguous sound-spelling relation. After training, children in the visual-dictation condition made fewer spelling errors on a dictation test than children in any of the other training conditions; this advantage could not be explained by differences in time on task.

The visual-dictation training integrates four instructional principles that have been identified as efficacious: Writing from memory, kinematics of writing/practicing targeted spelling difficulty in whole word, and immediate feedback by means of self-correction. We will discuss the merits of each of these principles in more detail.

Writing From Memory

When writing a text, writers typically produce the spelling of words from memory. Therefore, training in which writing words from memory is practiced may yield higher spelling gains than training in which the to-be-written words remain visible. This is corroborated

by the findings of several studies showing that writing words from memory during training leads to better results than simply copying words from a sheet of paper. In a spelling training with beginning readers, Roberts and Ehri (1983) observed that children who were trained on words they had to imagine achieved higher scores than children who were trained on words they could see on a piece of paper. This finding was obtained for both skilled and less skilled readers. Bosman and de Groot (1992) also tested beginning readers and found that spelling words from memory was more effective than copying words, particularly for children with spelling problems. These effects were replicated in subsequent spelling-training studies (Bosman & van Hell, 1999; van Leerdam et al., 1998).

Kinematics of Writing

The motor activity involved in handwriting is commonly assumed to benefit spelling performance: Handwriting enables children to benefit from motor feedback in learning to spell (e.g., Graham, 1999; Hulme & Bradley, 1983) and may contribute to strengthening orthographic knowledge (Berninger, Abbott et al., 1998). The importance of handwriting is supported by a study by Cunningham and Stanovich (1990), who examined the spelling performance of first graders. All children were presented with cards containing printed words that were read by the experimenter and subsequently repeated by the child. The child then had to copy the word by using either handwriting, letter tiles, or a computer keyboard. A subsequent dictation test showed that children in the handwriting condition performed better than children who had used letter tiles or the computer keyboard.

Whether children with spelling disabilities also benefit from the kinematics in handwriting remains unsettled. In spelling instruction with children with spelling disabilities, Berninger, Abbott et al. (1998) observed that children who had written by hand outperformed their peers who had used the computer, albeit only on relatively easy words. However, Vaughn, Schumm, and Gordon (1993) observed no benefits of handwriting over computer writing in their spelling training for children with learning disabilities (similar results were obtained with children without spelling disabilities). Still, children thought they learned spelling best when writing by hand, as revealed by a post-training interview.

The merits of kinematics have also been recognized in Orton-Gillingham's multisensory techniques, in which the student first traces (or sometimes writes) each letter in a word while simultaneously saying its name, and subsequently learns to read and spell (see Hulme & Bradley, 1983). The difference between our visual-dictation task and the standard multisensory technique is that in the latter each letter is connected to its sound through kinematics.

Practicing Targeted Spelling Difficulty in Entire Word

Many spelling methods, at least in the Netherlands, focus on a specific, typically ambiguous, sound-spelling relationship in a word. In learning the spelling of the word "zout," for example, Dutch children have to explicate the ambiguous grapheme [Au]. However, focusing on the ambiguous grapheme largely ignores the context of the whole word in which graphemes are embedded. This is unfortunate, since the contextual information surrounding the ambiguity is a potentially important cue and may contribute to spelling performance (Bosman & Van Orden, 1999; Treiman, Kessler, & Bick, 2002; for similar ideas in reading, see Stone et al., 1995; Treiman, Mullennix, Bijeljac-Babic, & Richmond-Welty, 1995). For example, the phoneme [a] can be spelled with either AA or A in Dutch. Generally, the ambiguity of this phoneme-grapheme relation declines rapidly in the context of the whole word. For example, in one-syllable words the phoneme [a] is always spelled AA, as in PAAL [pal] (*pole*), whereas in two-syllable words containing an open syllable, the experienced speller knows that the correct grapheme is A, as in KAMER [kam'r] (*room*).

The educational implication is that a spelling strategy in which children focus only on the ambiguous grapheme is less effective than a strategy in which children practice the whole word. Indeed, in several studies with beginning normal spellers, we found that the problem-naming method (in which children name the ambiguous phoneme) is less effective than methods in which children practice the spelling of the whole word (e.g., oral spelling; Bosman & de Groot, 1992; Bosman & van Hell, 1999; Bosman & van Leerdam, 1993; van Leerdam et al., 1999). These results are corroborated by recent studies emphasizing the importance of a functional spelling unit; for example, a grapheme associated with a particular phoneme (Berninger, Abbott et al., 1998; Berninger, Vaughan et al., 1998). As these researchers point out, a functional spelling unit may be larger than an individual letter and entail letter clusters.

Immediate Feedback and Self-Correction

Immediate feedback on the accuracy of the produced spelling is conducive to learning the spelling of words, both in children with (e.g., Kearney & Drabman, 1993) and in children without spelling disabilities (e.g., Gettinger, 1993). The spelling achievement of children with spelling disabilities was found to improve after using a contingent imitation procedure, a form of

immediate feedback in which the student's incorrect spelling of a word is imitated by the teacher before the correct spelling is shown (Gerber, 1986; Kauffman, Hallahan, Haas, Brame, & Boren, 1978; Nulman & Gerber, 1984).

Immediate feedback may lead to even higher gains if the students themselves, rather than the teacher, review and correct their spellings. Self-correction appears to be an important factor in learning to spell (e.g., Murphy, Hern, Williams, & McLaughlin, 1990; Vaughn et al., 1993). Inspecting the word you have just written and correcting it when necessary not only provides immediate feedback on the accuracy of the spelling of the word, it is also an important step in the development of self-monitoring skills (cf. Reid & Harris, 1993). Indeed, self-correction procedures enhanced the spelling performance of typically achieving spellers in third (Gettinger, 1993) and fourth (Harward, Allred, & Sudweeks, 1994) grades.

The Present Study

In the present study we explored the merits of visual-dictation training in children with spelling disabilities for two reasons. First, although visual dictation appeared effective in typically achieving spellers, we cannot assume that such training also enhances performance in children with spelling disabilities. Second, we sought to study its efficacy in three different subgroups of children with spelling disabilities. Until now, the majority of empirical studies in the literature have treated children with spelling problems as a group without making any further distinctions between subgroups of children with spelling disabilities in terms of intellectual capacities or behavioral problems (see, for example, Durrant, 1994, and Greenham, 1999, for comparable critiques of the literature on children with learning disabilities). This potentially obscures important differences between subgroups of children and limits the practical implications of the findings. Moreover, the alleged homogeneity of children with spelling disabilities in the research literature is at variance with the diversity of children experiencing spelling problems in school. Many professionals working with children with spelling disabilities (or children with learning disabilities in general) confirm that some children's poor academic achievement is mainly based on learning disabilities, whereas other children not only achieve poorly, but exhibit behavioral problems as well. In other words, children with spelling disabilities (or with learning disabilities in general) bring their own unique set of behaviors, thereby changing the conditions, or the context, in which learning takes place (e.g., Billet, 1996; Brown, Collins, & Guguid, 1989).

To obtain a specific and ecologically more valid insight into the effects of the spelling instruction, we tested three different subgroups of Dutch children with spelling disabilities. These subgroups of children attended three specific types of schools for special education in the Netherlands. One group attended a special education school for children diagnosed with developmental learning problems in a basic academic skill (e.g., reading, spelling, or arithmetic), but whose IQ scores fall within the normal or above-normal intelligence range (IQ scores > 85; the Dutch LOM-school, School for Learning and Educational Problems; all IQ scores mentioned in this article were determined by the Wechsler Intelligence Scale for Children-Revised). Based on a meta-analysis, Pijl and Pijl (1994) ascertained that school progress of children attending LOM-schools falls 1.4 *SD* below the mean score of their peers attending regular primary schools.

The second group of children attended a special school for children with poor academic achievement who are diagnosed with severe externalizing behavioral problems; their IQ scores fall within the normal or above-normal intelligence range (i.e., the Dutch ZMOK-school, School for Children with Severe Behavioral Problems). The academic achievements of these children are typically impeded by their behavioral problems, not so much by their intellectual capacities.

The third group of children attended a special school for children who are diagnosed with severe learning problems (i.e., the Dutch MLK-school, School for Children with Severe Learning Problems) believed to arise primarily from their relatively low intelligence (IQ scores ranging from 70 to 85). These children's school progress is estimated to fall 2.3 *SD* below that of their peers attending regular primary schools (Pijl & Pijl, 1994). At the time our training study was performed, about 10% of all Dutch school children from grades one to six attended a type of special education school (i.e., more than 120,000 children). Of these children, 35%, 7%, and 34% attended a LOM-school, a ZMOK-school and an MLK-school, respectively (Centraal Bureau voor de Statistiek; CBS, 1998).

Dutch vs. U.S. Classifications

For a better understanding of the students who participated in this study, we will briefly discuss similarities and differences between classifications in the Netherlands and the United States, using the work of Smith (2001). Our group of Dutch students with average or above-average intelligence, but who had severe spelling problems, coincides with the American classification of children with learning disabilities. Both the Dutch and the American classifications are based on a

discrepancy between potential and performance. That is, despite average or above-average intelligence, these children display difficulties in the acquisition of specific academic skills (e.g., spelling). Our group of Dutch students with spelling problems who also suffer from behavioral problems is similar to the American classification of children with emotional and behavioral disorders (e.g., conduct disorder, externalizing and internalizing behaviors). The Dutch students with below-average intelligence and spelling problems do not match the American classification criteria for mental retardation or cognitive impairment, since the American definition applies the below-70 IQ criterion. Intelligence levels of the present Dutch students varied between 70 and 85. In fact, children with intelligence levels between 70 and 85 are not classified as having mental retardation in the Netherlands either. However, when these Dutch students exhibit learning disabilities, they often attended, until recently,[1] a school for special education (i.e., MLK-school) and were referred to as MLK-students.

In our previous studies, we found that visual dictation benefits the spelling of words containing an ambiguous sound-spelling relationship (Bosman & van Hell, 1999; van Leerdam et al., 1998). This does not necessarily imply that the training also benefits the spelling of other difficult words; for instance, words containing a complex consonant cluster (e.g., Dutch "kunsthandel," *art shop*). It is widely recognized in psycholinguistic studies that language performance depends on word characteristics. To further examine the assets of visual dictation on learning as a function of a word's spelling difficulty, we trained the three subgroups of children with spelling disabilities on two different types of words: Words with ambiguous sound-spelling relations and words with complex consonant clusters. Words with ambiguous sound-spelling relations pose problems because the spelling of the words cannot be determined from their sound. Hence, the spelling of such words must be memorized. In contrast, the spelling of complex consonant clusters can be derived from a careful pronunciation of such clusters, a phonemic analysis. Although the spelling of complex consonant clusters follows the rules of sound-spelling relations in the language, studies of typically achieving beginning spellers showed that such words pose problems for children in the early stage of attaining literacy in English (e.g., Bruck & Treiman, 1990; Treiman, Zukowski, & Richmond-Welty, 1995) and in Dutch (van Bon & uit de Haag, 1997).

METHOD

Participants

Children from three types of schools for special education in the Netherlands participated in the experiment: 11 children with spelling problems (SP-group), 11 children with spelling problems and severe behavioral problems (SP+BP-group) and 11 children with spelling problems and relatively low intelligence (SP+LowIQ-group).

The children were selected from a larger group of children (40 SP-children, 23 SP+BP-children, 48 SP+LowIQ-children) on the basis of their scores on a spelling-dictation test (see Materials section). Children who scored between 47% to 77% words spelled correctly were selected. These children's mean spelling scores, age and gender are presented in Table 1.

Table 1
Mean Spelling Score, Age, and Gender Ratio of All Three Groups of Children

Group	Spelling Score	Age (in months)	Girls/Boys	*n*
SP	61 (9)	137.5 (9.6)	2/9	11
SP+BP	64 (10)	113.8 (10.1)	1/10	11
SP+LowIQ	64 (11)	151.4 (9.4)	7/4	11
Total	**63 (10)**	**134.2 (18.3)**	**10/23**	**33**

Note. SP = students with spelling problems; SP+BP = students with spelling problems and severe behavioral problems; SP+LowIQ = students with spelling problems and low intelligence. Standard deviations are presented in parentheses.

Table 2

Mean Spelling Scores (in Percentages) on Pretest, Posttest, and Retention Test of All Three Groups

	SP	SP+BP	SP+Low IQ
Pretest			
Ambiguous P-G relation	26 (18)	33 (13)	39 (19)
Complex consonant cluster	61 (14)	72 (8)	60 (22)
Posttest			
Ambiguous P-G relation	46 (20)	70 (16)	54 (24)
Complex consonant cluster	75 (18)	84 (13)	76 (13)
Retention test			
Ambiguous P-G relation	49 (23)	59 (21)	58 (17)
Complex consonant cluster	81 (14)	80 (11)	70 (18)

Note. SP = students with spelling problems; SP+BP = students with spelling problems and with severe behavioral problems; SP+LowIQ = students with spelling problems and with low intelligence.

An ANOVA confirmed that the mean spelling scores of the three groups (SP, SP+BP, SP+LowIQ) were equal before the training started, F (2, 30) = .21, p = .81. The mean age of the three groups differed significantly, F(2, 30) = 42.30, $p < 0.0001$. Specifically, the children with spelling problems and severe behavioral problems were younger (SP+BP; age 9-5) than the children with spelling problems (SP; age 11-6), who in turn were younger than the children with spelling problems and low IQ scores (SP+LowIQ; age 12-7); Fisher's PLSD, all p's < .05.

All children had received at least two years of spelling education prior to training. All children lived in an urban or suburban area in the Netherlands (Nijmegen, Wijchen and surroundings). Although they were from various socioeconomic backgrounds, the majority were from low- and middle-class backgrounds. All children were native Dutch speakers.

Materials

Two sets of materials were used: one set for the selection of the children and one set for the training. The spelling test used to select the children was based on interviews with 10 teachers of the schools of special education from which the children were selected, who were asked to identify words that posed spelling problems in their population. On the basis of these teachers' input, we constructed a dictation test consisting of 30 words that contained an ambiguous sound-spelling relationship, a complex consonant cluster, or both. (The selection materials are listed in Appendix A.)

The training materials consisted of 24 words: 12 words with complex consonant clusters (i.e., at least three successive consonants) and 12 words with ambiguous sound-spelling relations (e.g., [Ei] and [Au]). The two sets of training words were matched on the number of letters (complex consonant cluster: M = 9.83, SD = 1.53; ambiguous sound-spelling relation: M = 9.17, SD = 1.85; $t(22)$ = .96, $p > .10$) and on the number of syllables (complex consonant cluster: M = 2.58, SD = .51; ambiguous sound-spelling relation: M = 2.67, SD = .65; $t(22)$ = .35, $p > .10$). (The training materials are listed in Appendix B.)

Procedure

Training. The training took place at the children's schools three times a week for three weeks at a set time. Following the principles of the visual-dictation training, six words (three words with a complex consonant cluster and three words with an ambiguous sound-spelling relation) were practiced twice in each session. Individual trials proceeded as follows. Each word was presented on a card, in print, and the children had to study the word for 5 seconds. The card was covered and the children had to write the word down. The card was shown again, and the children had to check the spelling of the written word. In case of a misspelling, they had to correct their spelling by rewriting the

whole word. After the six words were trained, the children were presented with each word once more, following the same procedure.[2]

The training and testing of the children with SP and of the children with SP+LowIQ took place in two groups of five and six children each. The training of the children with SP+BP took place in groups of three or four children. The smaller size of the latter group was related to their severe behavioral problems and their concomitant lower attention span.

Three female M.A. students of special education delivered the training, one in each of the participating schools. Each of the trainers was an intern, appointed for one year at the school in which she gave the training. Hence, each trainer was familiar with the population of children at her school.

Test sessions: Pretest, posttest, and retention test. One week before the training started, a pretest was administered to the selected children. It was a dictation test and comprised all 24 training words. One week and one month after the training had ended, this dictation test was administered again as a posttest and a retention test, respectively.

RESULTS AND DISCUSSION

For each child, we calculated the mean percentage correct spellings for words with ambiguous sound-spelling relations and for words with complex consonant clusters separately for the pretest, posttest, and retention test.

Overall Analysis: All Children

A three (group: SP vs. SP+BP vs. SP+lowIQ) by three (test: pretest vs. posttest vs. retention test) by two (word type: ambiguous vs. consonant cluster) ANOVA on the percentage of correctly spelled words was performed. (The resulting means are presented in Table 2.) The ANOVA showed a significant three-way interaction between group, test, and word type, $F(4,60) = 2.75$, $p < .05$. To obtain a better view on the details of this interaction, we performed separate ANOVAs for each group of children. We report these separate analyses below.

The main effect of test was found to be significant, $F(2,60) = 44.66$, $p < .0001$. The percentage of correctly spelled words was significantly lower on the pretest ($M = 48\%$, $SD = 15$) than on the posttest ($M = 67\%$, $SD = 17$) and the retention test ($M = 66\%$, $SD = 16$);

Figure 1. Spelling performance of poor spellers.

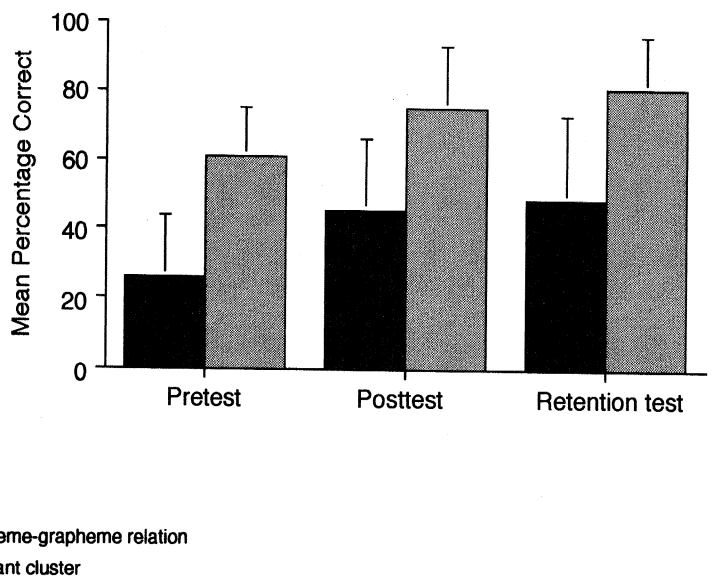
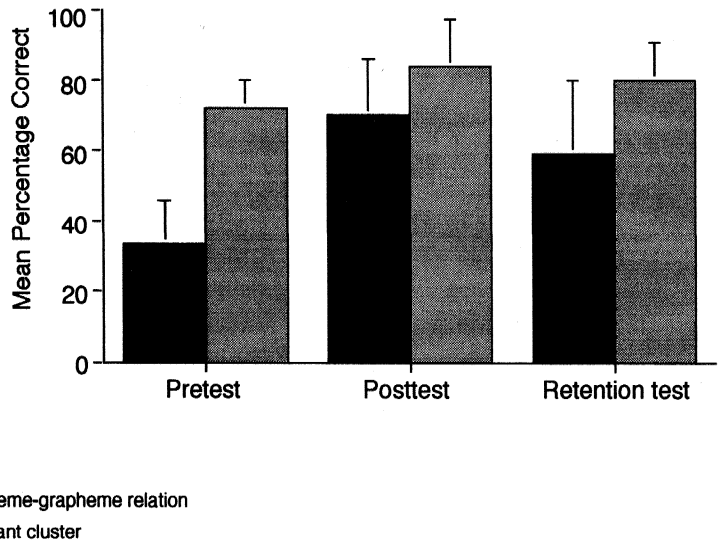


Figure 2. Spelling performance of poor spellers with severe behavioral problems.



Newman-Keuls, both p's < .01; the scores on the posttest and retention test were not significantly different. The main effect of word type was also significant, $F(1,30) = 244.36$, $p < .0001$: Words with complex consonant clusters ($M = 73\%$, $SD = 12$) were spelled correctly more often than words with ambiguous sound-spelling relations ($M = 48\%$, $SD = 17$). The main effect of group was not significant, $F(2,30) = 1.64$, $p > .10$.

The interaction between group and word type was significant, $F(2,30) = 6.09$, $p < .01$, as was the interaction between word type and test, $F(2,60) = 5.17$, $p < .01$. However, the interaction between group and test was not significant, $F(4,60) = 1.25$, $p > .10$. Since the first-order interactions were qualified by the significant second-order interaction (see above), we will not discuss the first-order interactions in detail. In the remainder of the Results section, we report separate ANOVAs for each subgroup of children to better understand the second order interaction.

Specific Analyses: Subgroups of Spellers

Performance of children with spelling problems. A three (test: pretest vs. posttest vs. retention test) by two (word type: ambiguous vs. consonant cluster) ANOVA on the mean percentage of correctly spelled words revealed a significant main effect of test, $F(2,20) = 23.76$, $p < .05$, and a significant main effect of word type, $F(1,10) = 175.68$, $p < .05$. The interaction between the two factors was not significant. (The means are presented in Figure 1.)

The children with spelling problems performed significantly better on the posttest and the retention test than on the pretest; Newman-Keuls, both p's < .01. Performances on the posttest and retention test were not significantly different, indicating that the children with spelling problems retained their increased spelling knowledge at least until one month after the training ended. Their performance on all three tests was better on the words with complex consonant clusters than on words with ambiguous sound-spelling relations.

In the upper part of Table 3, we list the gain scores of each of the 11 students in the SP-group. The gain score reflects the absolute difference between two test scores expressed in percentages (see Table 2). As illustrated in the first two columns, from pretest to posttest nine students increased and two maintained their knowledge on the words with ambiguous phoneme-grapheme

Table 3

Individual Gain Scores on Words with Ambiguous Phoneme-Grapheme Relations and Words with Complex Consonant Clusters From Pretest to Posttest, From Posttest to Retention Test, and From Pretest to Retention Test

	Pretest to Posttest		Posttest to Retention test		Pretest to Retention test	
Speller	Ambiguous P-G relation	CC-cluster	Ambiguous P-G relation	CC-cluster	Ambiguous P-G relation	CC-cluster
			Students with spelling problems			
1	25	8	17	17	42	25
2	17	17	8	0	25	17
3	17	-8	-8	33	8	25
4	25	33	0	-8	25	25
5	17	0	17	25	33	25
6	25	8	8	17	33	25
7	0	17	8	0	8	17
8	17	42	0	-17	17	25
9	0	33	-25	-17	-25	17
10	25	8	-17	8	8	17
11	58	0	8	8	67	8
			Students with spelling and behavioral problems			
1	50	17	-8	0	42	17
2	8	-17	-8	25	0	8
3	25	17	0	17	25	33
4	67	25	17	-17	83	8
5	25	8	0	8	25	17
6	8	-8	8	0	17	-8
7	25	0	-17	-8	8	-8
8	42	25	-25	-25	17	0
9	58	33	-42	-25	17	8
10	50	8	-8	0	42	8
11	42	25	-33	-17	8	8
			Students with spelling problems and low IQ			
1	42	8	-25	0	17	8
2	8	33	17	8	25	42
3	17	25	0	-17	17	8
4	33	17	-8	8	25	25
5	8	-25	8	-8	17	-33
6	33	25	17	8	50	33
7	-8	8	17	-8	8	0
8	17	17	0	-25	17	-8
9	8	8	0	0	8	8
10	25	42	8	-42	33	0
11	-8	17	17	8	8	25

Note. A positive number indicates an increase in the number of correct spellings, whereas a negative number indicates a decrease in spelling performance.

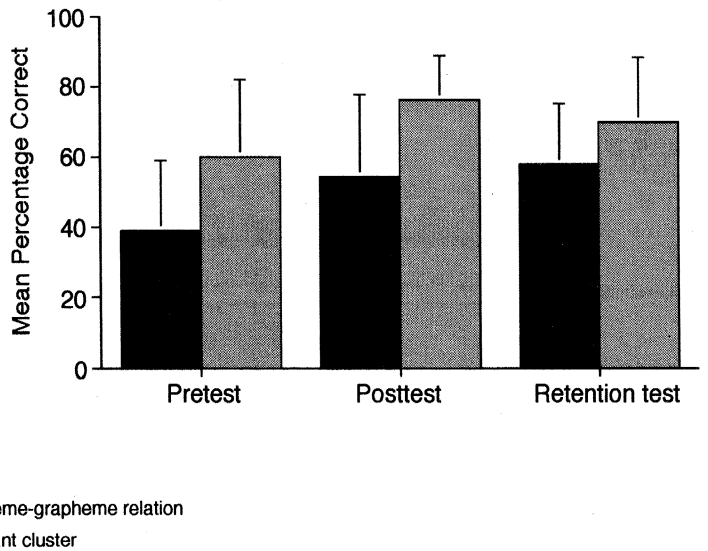
relations. On the words with complex consonant clusters eight students increased and two retained their spelling knowledge. From posttest to retention test, eight students retained or gained spelling knowledge in both conditions. However, in the most interesting condition, that is, from pretest to retention test, all children in both conditions showed increased spelling knowledge, except one student in the condition with words with ambiguous phoneme-grapheme relations.

Performance of children with spelling problems and severe behavioral problems. A three (test: pretest vs. posttest vs. retention test) by two (word type: ambiguous vs. consonant cluster) ANOVA on the mean percentage of correctly spelled words revealed a significant main effect of test, $F(2,20) = 14.74$, $p < .05$, and a significant main effect of word type, $F(1,10) = 84.83$, $p < .05$. These main effects were qualified by a significant interaction between test and word type, $F(2,20) = 10.77$, $p < .05$. (The means are presented in Figure 2.)

For both types of words, spelling performance improved from pretest to posttest. However, scores on the words with ambiguous sound-spelling relations were lower on the retention test ($M = 59\%$, $SD = 21$) than on the posttest ($M = 70\%$, $SD = 16$), whereas performance on words with complex consonant clusters remained similar across the retention test ($M = 80\%$, $SD = 11$) and the posttest ($M = 84\%$, $SD = 13$). Still, the retention test score on words with ambiguous sound-spelling relations ($M = 59\%$, $SD = 21$) was higher than the pretest score on these words ($M = 33\%$, $SD = 13$).

In the middle part of Table 3, we list the gain scores of each of the 11 students in the SP+BP-group. As shown, from pretest to posttest, all students increased their knowledge on the words with ambiguous phoneme-grapheme relations. On the words with complex consonant clusters eight students increased their knowledge, one retained, and two lost some of their spelling knowledge from pretest to posttest. From posttest to retention test, four students gained or retained their knowledge on words with ambiguous phoneme-grapheme relations, whereas seven students' spelling knowledge had decreased. On the words with complex consonant clusters, six gained or retained and five lost some of their knowledge. Again, in the most interesting condition, that is, from pretest to retention test, the spelling knowledge of 10 students

Figure 3. Spelling performance of poor spellers with low IQ.



had increased and that of one remained the same on words with ambiguous phoneme-grapheme relations. On words with complex consonant clusters, eight students increased their knowledge, one retained, and two lost some of their spelling knowledge from pretest to retention test.

Performance of children with spelling problems and low IQs. A three (test: pretest vs. posttest vs. retention test) by two (word type: ambiguous vs. consonant cluster) ANOVA on the mean percentage of correctly spelled words revealed a significant main effect of test, $F(2,20) = 11.12$, $p < .05$, and a significant main effect of word type, $F(1,10) = 33.55$, $p < .05$. As in the data on the children with spelling problems, the interaction between the two factors was not significant. (The means are presented in Figure 3.)

The spelling performance of the children with spelling problems and low IQs improved significantly from pretest to posttest; Newman-Keuls, $p < .01$. Performances on the posttest and the retention test were not statistically different, indicating that even in children with spelling problems and low IQs, the training benefits were preserved until at least one month after the training.

In the lower part of Table 3, we list the gain scores of each of the 11 students in the SP+Low IQ-group. As illustrated, the first two columns show that from pretest to posttest all students' spelling knowledge had increased, except for two students on words with ambiguous phoneme-grapheme relations and for one student on words with complex consonant clusters. From posttest to retention test, nine students retained or gained spelling knowledge on words with ambiguous phoneme-grapheme relations and six on words with complex consonant clusters. From pretest to retention test, all students' knowledge on words with ambiguous phoneme-grapheme relations and the knowledge of seven students on words with complex consonant clusters showed an increase.

GENERAL DISCUSSION

A spelling training, visual dictation, was implemented with three subgroups of children with spelling disabilities: Children with spelling problems whose IQ scores fell within the normal or above-normal range, children with spelling problems and low IQ scores, and children with spelling problems and severe behavioral problems. Two types of words were trained: words with ambiguous sound-spelling relations and words with complex consonant clusters.

Visual dictation appeared to be effective in all three subgroups of children. That is, the spelling performance on the two types of words improved considerably from pretest (administered one week before the training) to posttest (administered one week after the training had ended). Moreover, the positive effects of the visual-dictation training were sustained, as spelling performance on the retention test (administered one month after the training had ended) remained equal to that on the posttest. The only exceptions were the children with spelling problems and severe behavioral problems, whose performance on the words with ambiguous sound-spelling relations dropped from posttest to retention test (from 70% to 59% correctly spelled words). It should be noted, however, that their mean retention test score was still considerably higher than their mean pretest score (33% correctly spelled words). More important, however, is the fact that individual gain scores from pretest to retention test show that spelling knowledge had increased in almost all children. Considering that after the posttest no further training took place and that the time between posttest and retention test was one month, this is a truly impressive performance by students with spelling disabilities who were taught a rather difficult set of words.

As anticipated, performance on the trained words did not reach perfection, since the words selected were orthographically unfamiliar, but semantically familiar. The reason for this seemingly odd choice is that we wanted to be sure that the spelling of the experimental words was relatively unfamiliar to *all* three types of students, whose reading experience and age levels diverged quite a bit.

The effectiveness of the visual-dictation training parallels the findings of Murphy et al. (1990), who implemented a training, called "copy-cover-compare," which shares basic principles with visual dictation. In the copy-cover-compare training, children examine a word, copy it, cover it and write the word from memory, and check their spelling. If the word is spelled correctly, they proceed to the next word; if the word is spelled incorrectly, they return to the first step. Murphy et al. found that the copy-cover-compare training was successful in their sample of nine children with learning disabilities with average to above-average IQs (ages ranged from 8-8 to 12-3 years; the authors did not describe whether or not these children also had behavioral problems).

Spelling Instruction: Subgroups of Spellers

The finding that the visual-dictation training was effective in three different subgroups of children with poor spelling skills suggests that the ways in which children from these different populations learn and retain spelling knowledge is highly comparable. This is remarkable, as these children not only differed in terms of intelligence, cognition, and behavior, but also in

age. Due to the matching on pretraining spelling performance, the children with spelling problems and severe behavioral problems were two years younger than the children with spelling problems and IQ scores within the normal or above-normal intelligence range, who in turn were one year younger than the children with spelling problems who experienced severe learning problems in general related to their low intelligence. The theoretical implication is that differences between these subgroups of Dutch-speaking children with disabilities in learning the spelling of words, that is, words with ambiguous sound-spelling relationships and words with complex consonant clusters, are essentially quantitative, not qualitative.

An analogous conclusion was reached by Treiman (1997) in her comprehensive review, in which she compares the spelling performance of children with spelling problems (without making further distinctions between subgroups) and children without spelling problems. Treiman concluded that differences between these two groups of children were quantitative rather than qualitative. That is, the spelling performance of children with spelling problems is worse than that of their typically achieving peers, but is similar to that of younger typically achieving children with respect to misordering errors (e.g., "yuo" for "you"), reversal errors (e.g., "dull" for "bull"; examples are from Treiman), and the ability to spell words and nonwords in a "phonetic" manner.[3] The implication for spelling training is that different subgroups of children with spelling disabilities, as well as children without spelling disabilities (see Bosman & van Hell, 1999; van Leerdam et al., 1998), may benefit from similar training principles (i.e., visual dictation).

Although the general principles of the spelling instruction examined here may benefit different subgroups of children with and without spelling disabilities, we do not recommend a one-size-fits-all program. The preconditions for spelling instruction should be adjusted to the specific instructional needs of subgroups of children with spelling disabilities in order to optimize their performance. One example of such an adjustment is the number of words to be learned within a single session. In our visual-dictation training with spellers without spelling disabilities from Grade 1, positive effects were obtained with children learning the spelling of 12 words in one session (Bosman & van Hell, 1999; van Leerdam et al., 1998). In the present training with children with spelling disabilities, we decreased the number of words to be learned in a single session to six, thereby converging recommendations made in the literature on the spelling performance of children with learning disabilities (Bryant, Drabin, & Gettinger, 1981; Graham, 1999).

Another adjustment made to optimize children's performance involves the size of the groups in which the children received their training. The group size of the children with spelling problems and that of the children with spelling problems and low IQs was five or six. The group size of the children with spelling problems and severe behavioral problems was smaller, ranging from three to four. As mentioned, the smaller group size was motivated by the specific instructional needs related to their behavior.

In a Dutch study, Blöte-Aanhane and Curfs (1984) compared teacher ratings of the behavior of children attending the three types of schools for special education our children were selected from (i.e., LOM: children with SP; MLK: children with SP and low IQs; ZMOK: children with SP and severe behavioral problems). Blöte-Aanhane and Curfs' study found a marked difference in the behavior of the latter children compared to that of the former two subgroups. That is, children attending the ZMOK-school were perceived by their teachers as exhibiting antisocial and acting-out behavior and displaying externalizing behavior that conflicted with the environment and challenged their teachers. The behavioral pattern of the children in our sample coincided with that of the larger population studied by Blöte-Aanhane and Curfs, and converges with the results of other studies indicating that children with learning disabilities who exhibit externalizing behavior problems (e.g., aggressive-disruptive, acting-out, impulsive, or hyperactive-inattentive behavior) often show difficulties in self-regulation and goal-directed behavior, and have attention and concentration problems that constrain their academic achievement (Campbell, 1995; Greenham, 1999). Their increased levels of activity and distractibility challenge teachers (Kavale & Forness, 1996) and require considerably more teacher attention. This is corroborated by a recent study by Greene, Beszterczey, Katzenstein, Park, and Goring (2002), who found that teachers engage in significantly higher rates of interaction (including negative, positive, neutral, and providing help) with children with attention deficit hyperactivity disorder (ADHD) than children without ADHD. The practical implication for spelling instruction is that instruction should be given in small groups.

Although many children with spelling disabilities benefit from a systematic and structured training (Graham, 1999, 2000), this may be particularly true for children with severe behavioral problems. The importance of a well-structured learning situation, and the lack thereof in the administration of the retention test, may explain why the spelling performance on the retention test of the children with spelling problems and behavioral problems, in contrast to that of the

other two subgroups of children with poor spelling skills, dropped. The retention test took place one month after the training had finished, and thus fell outside the well-structured training program. Although the retention test was announced in advance, its administration caused distress in the children with spelling problems and severe behavioral problems, who became upset by the change in their routine. The performance drop on the retention test was particularly strong for words with ambiguous sound-spelling relations, suggesting that the former set of words, generally perceived to be the most difficult word class (see below), is more vulnerable to disruption.[4]

Finally, many researchers have pointed at the co-occurrence of externalizing behavioral problems and academic underachievement in children (e.g., Barry, Lyman, & Klinger, 2002; Hinshaw, 1992). Our study did not focus on academic underachievement. Nevertheless we observed that, under highly structured conditions, the spelling performance of the children with spelling problems and behavioral problems was comparable to that of the other two groups of spellers, even though these children were considerably younger. This suggests that the overall poor academic achievement of the children with spelling and behavioral problems (which prompted their assignment to a specific school for special education) is more related to their behavioral problems than to their learning disabilities per se. Their improved spelling performance during visual-dictation training, being a highly structured training program administered in a small group, underlines the importance of tailoring the preconditions of the training to their specific instructional needs in order to optimize academic achievement in these children.

Spelling Instruction: Subgroups of Words

Two classes of words were trained in the visual-dictation training: words with ambiguous sound-spelling relations and words with complex consonant clusters. If we focus on the effectiveness of visual dictation in learning these words as measured by the posttest administered one week after the training, the children's spelling gains for words with ambiguous sound-spelling relations (24%) were higher than for words with complex consonant clusters (14%); this differential increase was statistically significant, $F(1,32) = 6.75$, $p < .05$.[5]

Thus, visual dictation is particularly helpful in learning words containing a spelling ambiguity. A potential explanation relates to the child's (meta)cognitive operations involved in learning the spelling of the two types of words. The spelling of words with sound-to-spelling consistent consonant clusters can be derived by applying phonemic analysis. This means that when studying, writing from memory, and checking the spelling of a word with a complex consonant cluster (e.g., "kunsthandel"), the child may realize that the word looks difficult at first, but that she can write the correct spelling when she pronounces the word carefully. This insight parallels observations on the development of spelling knowledge in beginning spellers without spelling problems. In the earliest stages of literacy, children tend to omit graphemes in complex consonant clusters; for example, they omit the r in *Street*; but the frequency of such errors decreases as children's spelling skills increase (Treiman et al., 1995; van Bon & uit de Haag, 1997). However, in the case of words with ambiguous sound-spelling relations, phonemic analysis does not help to spell the word, and during the visual-dictation training the child may realize that the spelling of these words can only be learned via visual memorization.

Our finding that visual dictation may be particularly helpful in words with ambiguous sound-spelling relations is corroborated by the findings in an early study by Kauffman et al. (1978), who taught one boy with spelling disabilities the spelling of 10 phonetically regular and 10 phonetically irregular words using two methods. Their most effective training procedure, which shares basic principles with the visual-dictation training in this study (although Kauffmann et al. used a different feedback procedure in which they imitated the boy's error before presenting the correct spelling of a word rather than self-correction) appeared relatively successful in learning and retaining the spellings of phonetically inconsistent words.

It is important to note that one month after the training had finished, the children had largely retained the spellings of both words with ambiguous sound-spelling relations and those with complex consonant clusters. This suggests that the acquired spelling knowledge of both types of words remained memorized well after the training had ended. Only the children with spelling problems and behavioral problems obtained lower scores on words with ambiguous sound-spelling relations on the retention test than on the posttest, but their mean retention test score was still well above the corresponding pretest score. Earlier we offered a potential explanation for this observation.

As is clear from the discussion above, visual dictation has more to offer for learning the spelling of sound-to-spelling inconsistent words than for words with complex consonant clusters. The finding that the gain scores of these words are generally higher than those of the words with complex consonant clusters suggests that it is more effective for the former set of words. This implies that variation in consistency in sound-spelling

relations across languages constrains its applicability. As mentioned, in some languages, like Finnish and Spanish, sound-spelling relations are highly predictable and phonemes have a one-to-one correspondence with graphemes. Children learning the spelling of words in these languages can make use of this consistency via phonemic analysis, and their spelling benefits from a careful pronunciation of the word rather than methods like visual dictation. By comparison, children acquiring the spelling of languages with a high number of ambiguous sound-spelling relations, like English, French, and Dutch, can potentially profit from the visual-dictation training.

Implications for Practice

A practical asset of the visual-dictation training, and of the related method "copy-cover-compare," is that it is easy to administer and integrate in a curriculum. Moreover, it directly focuses on teaching relevant spelling skills and encourages children to become more self-directed learners. To exemplify the latter issue, the self-correction phase (in which children check their spelling of the word against the model and, if incorrect, correct their spelling by rewriting the whole word) contributes to the development of self-monitoring skills, and to the development of metacognitive skills in general (Reid & Harris, 1993; Vaughn et al., 1993), and to an enhanced feeling of self-efficacy. Previous studies have shown that self-correction procedures improve the spelling performance of typically achieving children (Gettinger et al., 1994; Harward, 1993). Our study, as well as that of Murphy et al. (1990), showed that a spelling training that contains self-correction also enhances the spelling performance in three subgroups of children with spelling disabilities, including children with low IQs and severe behavioral problems.

One caveat of the self-correction procedure (in fact, of any procedure involving error feedback) is that children may become highly sensitive to errors. In their single-case study testing two error-correction procedures (i.e., contingent imitation and modeling) in a boy with learning disabilities, Nulman and Gerber (1984) noted that although the boy's spelling performance improved, he perceived the error-correction procedures as punishment. Similarly, in a spelling treatment performed in our clinical lab (at the Department of Special Education, University of Nijmegen), in which we applied the visual-dictation instruction to an 8-7-year-old boy with severe spelling problems, we observed that he became overly sensitive to his errors. Thus, despite his steady progress, he became more and more upset by the errors he made, ignoring his increasingly higher number of correct spellings. However, the introduction of a simple two-colored chip system in which a chip was turned around (thereby changing color) for every correct spelling appeared to alleviate (and eventually practically eliminate) his distorted view of the ratio of incorrect vs. correct spellings. Thus, this visualization of his ratio of incorrect and correct spellings helped him to appreciate his spelling progress.

In our study, we used the visual-dictation training for learning the spelling of a list of experimenter-prepared words. The same basic principles can be used in individualized instruction, where words are trained that were previously diagnosed to pose problems for a particular child. Moreover, such individualized and fine-tuned instruction is suitable for computer-assisted instruction, in which the basic principles of the visual-dictation training (studying, writing from memory, and checking the spelling of a word) are implemented in a computer program, and in which the teacher enters an individualized word list for each student. However, by using a computer, the child cannot benefit from the kinematical feedback writing by hand may provide. Future research should determine its consequences for the general efficacy of visual dictation. One additional advantage of computer-assisted instruction is that typing on the computer overcomes handwriting problems, and the concomitant problem of having to spend too much attention to the motor aspects involved in handwriting, in children with spelling disabilities who also experience problems in handwriting (see Berninger, Abbott et al., 1998; Graham, 1999).

Epilogue

We argued that the visual-dictation training would be particularly helpful in learning words with ambiguous sound-spelling relations. When learning the spelling of words with a complex consonant cluster, or sound-to-spelling consistent words in general, children will benefit from instruction based on phonemic analysis, thereby using the consistency between graphemes and phonemes that exists in many languages, and the important role of phonology in reading and spelling (e.g., Bosman & Van Orden, 1999). What is more, we recently observed that in learning the spellings of loan words, a subclass of sound-to-spelling inconsistent words, children benefit from pronouncing the word according to consistent sound-spelling rules. For example, we taught children to spell the English loan word "Jungle" as [jun][Gl'], in line with Dutch sound-spelling rules (Schiffelers, Bosman, & van Hell, 2002). This instruction appeared to benefit the spelling of loan words in both children with and without spelling disabilities. In view of the diverse grapheme-phoneme relations within most languages, we maintain that

instructional methods for teaching the spelling of words should reflect this diversity. Rather than teaching children to learn the spelling of words following one uniform training, as if one size would fit all, we advocate that spelling instruction be fine-tuned to the specific grapheme-phoneme relations of a word class.

Future research should explore the extent to which children themselves are able to choose among the different methods. Ideally, spelling instruction first teaches children to analyze the sound-spelling relations of a word (e.g., ambiguous or consistent), after which they choose a method that is most appropriate to learn the spelling of this word (visual dictation or phonemic analysis, respectively). This places high demands on the metacognitive strategies of the learner, and future research should determine the extent to which different subgroups of children with spelling disabilities are able to follow this strategy, and which preconditions must be met to optimize their performance.

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APPENDIX A

Dutch Words (with English Translation in Parentheses) Used in Participant Selection

soms (sometimes)	prachtig (beautiful)
friet (chips)	mars (march)
strand (beach)	gezeur (nagging)
gierig (stingy)	geeuw (yawn)
flauw (silly)	kiezen (molars)
langs (along)	zweet (sweat)
plooi (pleat)	rits (zipper)
erg (bad)	ploeg (plough)
kieuw (grill)	blijf (stay/remain)
scheert (shaves)	zonk (sank)
vriend (friend)	hoofd (head)
circus (circus)	iglo (igloo)
nacht (night)	duwtje (little push)
koning (king)	geitje (little goat)
kruipt (crawls)	einde (end)

APPENDIX B

Stimulus Words (with English Translations in Parentheses) Containing Ambiguous Phoneme-Grapheme Relations or Complex Consonant Clusters Used in the Training

Ambiguous Phoneme-Grapheme Relations	*Complex Consonant Clusters*
drijfhout (drift wood)	borstkas (chest)
blauwbaard (blue beard)	kunsthandel (art shop)
levensecht (lifelike)	trommelstok (drum stick)
geheimzinnig (mysterious)	glinsteren (sparkle)
politie (police)	zwerfkatten (alley cats)
bouwval (ruin)	melkkruk (milk stool)
achterlijf (abdomen)	kerstbal (Christmas ball)
reizigers (travelers)	stripboeken (comic books)
nieuwigheid (novelty)	krulspelden (curlers)
schiereiland (peninsula)	marktkoopman (market vendor)
zeemeeuw (sea gull)	rotstreek (rotten trick)
fluweel (velvet)	hoestbui (coughing fit)

FOOTNOTES

[1] We added the nuance "until recently," because in 1999, one year after we conducted our study, the Dutch educational system changed drastically. Both LOM- and MLK-schools were abolished and merged into a new type of school, a primary school for special education. As a result, children who traditionally would have been referred to a LOM- or MLK-school now remain in regular education and are eligible for extra help in or outside their classroom.

[2] This procedure was followed for all children, with the exception of the poor spellers with low IQs, who, unintentionally, were presented with the words only once.

[3] Treiman points at one aspect in which children with spelling problems may experience more difficulties, namely, in carrying out a fine-grained analysis of spoken words. She proposes that the resulting errors (e.g., "crd" for "card") may be relatively persistent in children with spelling problems.

[4] As noted by a reviewer, it is possible that children with behavioral problems would have benefited more from Orton-Gillingham's multisensory techniques as discussed in the introduction, because it forces the speller to be even more involved in the spelling process and as such leaves little room for distraction. Whether or not these children gain more from this technique warrants new research.

[5] Although the pretest performance on words with complex consonant clusters was better than on words with ambiguous sound-spelling relations, posttest performance on words with complex consonant clusters did not reach a ceiling (see Table 2).

NOTES

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Requests for reprints should be addressed to: Janet G. van Hell, University of Nijmegen, Department of Special Education, PO Box 9104, 6500 HE Nijmegen, The Netherlands (e-mail: J.vanHell@ped.kun.nl)

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