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Improving Spelling Performance and Spelling Consciousness

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This study examined the immediate and sustained effects of three training conditions on both spelling performance and spelling consciousness of 72 third-grade low- and high-skilled spellers. Spellers were assigned to a strategy-instruction, self-correction, or no-correction condition. The role of spelling ability and word characteristic were also taken into account. Regarding the immediate effects, the strategy-instruction condition was more effective for spelling performance, and more effective for spelling consciousness pertaining to loan words than the no-correction condition. Regarding the sustained effects on spelling performance and spelling consciousness, the positive effect of the strategy-instruction condition faded out after training. The four training sessions were insufficient for establishing long-lasting effects.

Keywords *spelling performance, spelling consciousness, spelling training, strategy instruction, self-correction*

WHEN STUDENTS FIRST learn to spell, they have to acquire the ability to segment words into phonemes and to connect phonemes to their corresponding graphemes. For words with consistent phoneme-to-grapheme relations (e.g., STOP and STAR), this process is fairly easy. For words with inconsistent phoneme-to-grapheme relations (e.g., CHEAP and CHOIR), however, this conversion process cannot be applied without additional knowledge of phonological, morphological, or orthographic rules. To be able to spell these inconsistent words correctly, awareness of the spelling rules and knowing when and how to apply them is required. Knowledge of one's spelling difficulties and the ability to detect and correct one's spelling errors is known as spelling consciousness (Block & Peskowitz, 1990; Bosman, 2004; Lull, 1917).

Spelling Consciousness

One way of assessing spelling consciousness is having spellers assess whether the spelling they produced is correct or incorrect. Various studies have shown that primary-school students are often unable to accurately evaluate their own spellings (Koning, 1985; McFarland 1916, as cited in Lull, 1917; Tidyman, 1919). More specifically, students find it particularly hard to correctly indicate when they misspelled a word (Hendrikson & Pechstein, 1926; Tidyman,

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1919). Students, however, do not lack spelling consciousness altogether. An example is a Dutch study concerning a free-writing assignment: Sixth-grade students used mainly words that they knew how to spell (Jansen-Donderwinkel, Bosman, & van Hell, 2002). Moreover, even second-grade students ask their teachers about words that they are unsure about (Gunderson, 1943). Nevertheless, with respect to spelling consciousness, large individual differences exist between students (Hendrickson & Pechstein, 1926; Kreiner & Green, 2000).

Spelling consciousness and spelling performance are positively related (Block & Peskowitz, 1990; Hendrickson & Pechstein, 1926; Lull, 1917). Perhaps, improving spelling consciousness improves students spelling performance. Paffen and Bosman (2005) demonstrated that spelling consciousness can be improved by a training that consisted of five sessions only. Students in the experimental condition were first made aware of their spelling difficulties and were subsequently instructed to use meta-cognitive strategies. After the training, students in both the experimental and control group were better at evaluating the correctness of their own spelling, but students in the experimental group improved significantly more. That the pretest (and the posttest) consisted of a large number of words to evaluate (i.e., 200 words) may have enhanced the students' awareness of their spelling ability, and consequently had an effect on their judgments on the posttest. Thus, it appears that spelling consciousness can be improved using a short training aimed at using meta-cognitive strategies. Whether spelling consciousness can also be improved by adequate spelling instruction is not yet clear.

Spelling Instruction

A large number of studies have shown that adequate spelling performance requires formal spelling instruction (e.g., Bosman, 2004; Bosman & de Groot, 1992; Butyniec-Thomas & Woloshyn, 1997; Devonshire & Fluck, 2010; Faber, 2006; Fulk & Stormont-Spurgin, 1995; Gettinger, Bryant, & Fayne, 1982; Graham, 1999, 2000; Wanzek et al., 2006), particularly for poor spellers (Gettinger et al., 1982; Graham, 1999, 2000).

Van Leerdam, Bosman, and Van Orden (1998) showed that spelling instruction needs to be geared to the particular spelling difficulty of the word, because no one-size-fits-all approach exists. For example, learning the spelling of words with ambiguous phoneme-to-grapheme relations is different from learning words with inconsistent phoneme-to-grapheme relations. Words with ambiguous phoneme-to-grapheme relations contain one or more phonemes that can be spelled multiple ways; for example, the [i:] in the English word *cheap* is an ambiguous phoneme, because there is also an alternative *ee* spelling, as in *keep*. Words with inconsistent phoneme-to-grapheme relations contain graphemes of which the pronunciation deviates from the prototypical one; for example, the English word *pint* is pronounced differently from *hint*, *mint*, and *tint*. Words such as *choir* and *bourgeois*, also known as strange words, also belong to this category. Research has shown that the spelling of words with ambiguous phoneme-to-grapheme relations are best taught by means of visual dictation (Bosman & van Hell, 1999; van Hell, Bosman, & Bartelings, 2003), whereas words with inconsistent phoneme-to-grapheme relations are most effectively learned by overpronunciation or regularizing the spelling (Bosman, van Hell, & Verhoeven, 2006). Regularizing the spelling requires students to read the particular word aloud according to prototypical grapheme-to-phoneme relations.

Strategy Instruction

An important aspect that appears to enhance spelling performance, and, as a result the self-teaching skills of spellers, is to develop spelling strategies. Instruction of spelling rules (Butyniec-Thomas & Woloshyn, 1997; Kernaghan & Woloshyn, 1995; Paffen & Bosman, 2005), application of syllable segmentation (Butyniec-Thomas & Woloshyn, 1997), and visual imagery (Kernaghan & Woloshyn, 1995) are often part of a spelling-strategy training. Word spellings that obey rules require the explanation and practicing of the rule (Butyniec-Thomas & Woloshyn, 1997; Cordewener, Bosman, & Verhoeven, 2014; Darch, Eaves, Crowe, Simmons, & Conniff, 2006; Hilte & Reitsma, 2011; Kemper, Verhoeven, & Bosman, 2012). In Dutch, rules are determined by phonological, morphological, and/or orthographic principles. When students learn to use spelling rules, they are most likely to develop the ability to spell unfamiliar words that belong to that specific category. In the Paffen and Bosman (2005) training, students learned to use meta-cognitive strategies that entailed that they pronounced the word carefully, segmented it into syllables, and recalled the spelling rule that had to be applied to spell that syllable correctly. The training was highly effective for both poor and good readers/spellers.

Self-correction

In a self-correction procedure, students usually compare their spellings with a model; in case it is misspelled they write the correct spelling next to the incorrectly spelled word (Morton, Heward, & Alber, 1998). Self-correction is effective in students in general education (McGuffin, Martz, & Heron, 1997; Wirtz, Gardner, Weber, & Bullara, 1996), special education (Grskovic & Belfiore, 1996), and in students with learning disabilities (McNeish, Heron, & Okyere, 1992). Gettinger (1985) showed that spelling performance of poor spellers increased more when students had to find the errors themselves than when the teacher marked the errors. Block and Peskowitz (1990) showed that self-correction increased spelling consciousness. Students had to indicate prior to writing the word, whether they believed they were able to spell the word correctly. After they had written the word, they were asked whether they thought they had written the word correctly or not. Visual inspection of the word—particularly when the word was also read aloud—increased the accuracy with which students were able to indicate the correctness of their spellings. Thus, self-correction appears to improve spelling performance and spelling consciousness.

Spelling Ability and Word Characteristics

There is not yet consensus about the question of whether spelling instruction for poor spellers should be the same as for good spellers. Jansen-Donderwinkel and colleagues (2002) showed that the spelling consciousness of students from regular education was better than that of students from special education. Students from special education usually also have a lower spelling level than students from regular education. The inference that poor spellers may have a lower spelling consciousness than good spellers is corroborated by a study of Deshler, Ferrell, and Kass (1978). Interestingly, poor spellers are more confident about their spellings than good spellers and are consequently less inclined to check their spellings (see also Snow 1989, as cited in Block & Peskowitz, 1990).

Two studies by Willemen, Bosman, and van Hell (2000, 2002) also provided evidence for the assumption that spelling consciousness and the strategies of poor spellers are dissimilar from those of good spellers. Spellers from both special and regular education took part in a self-correction training in which they were explicitly taught to use strategies for self-correction. Students in the control group did not receive instructions but were simply asked to correct their work. Spelling performance of students in the training group increased more than that of those in the control group. It is interesting that spelling performance of students from regular education who participated in the control group also increased, whereas that of students in special education did not. This study showed that poor spellers depend more on spelling instruction than good spellers, but in the Paffen and Bosman study (2005), spelling consciousness of poor readers/spellers increased as much as that of good readers/spellers after training. To what extent poor spellers benefit as much from instruction in spelling and spelling strategies as good spellers is still unsettled. This study will, therefore, also address differential effects of spelling ability.

Another issue that will be investigated is the effect of word characteristics on spelling performance and spelling consciousness. The Dutch language contains native Dutch and non-native Dutch words. The spelling of native Dutch words is based on Dutch spelling rules, whereas non-native Dutch or loan words cannot be spelled according to Dutch spelling rules (Bosman, 2004). To accurately measure spelling consciousness, words that could be spelled correctly (native Dutch) as well as words that most probably could not be spelled correctly (loan words) have to be included in the study. Moreover, loan words are not included in the training; the strategy that is taught can only be applied to native Dutch words. Note, however, that some of the strategies can be applied to parts of the loan words. For these reasons, and because loan words are part of Dutch spelling education, it is interesting to examine whether students also make progress in both spelling consciousness and spelling performance on loan words.

Present Study

The main goal of this study is to answer the question "Which condition is most effective for the improvement of both spelling performance and spelling consciousness?" Three training conditions were developed for students in third grade: a strategy-instruction condition, a self-correction condition, and a no-correction condition.

We used a strategy-instruction condition because it appears to be effective for improving both spelling performance and spelling consciousness of poor and good spellers (Paffen & Bosman, 2005). The strategy-instruction condition aimed at teaching students a more or less integral spelling strategy that they can apply to different kinds of words. This strategy included the effective aspects of dividing words into syllables (Butyniec-Thomas & Woloshyn, 1997; Kernaghan & Woloshyn, 1995; Paffen & Bosman, 2005) and applying one or more spelling rules (Butyniec-Thomas & Woloshyn, 1997; Paffen & Bosman, 2005). This strategy had to be applied by means of self-verbalization. Self-verbalization leads to better memorization of spelling rules (van Bon, Coenen, & Vlek, 1986; van Bon & Cremers, 1983). By teaching students to divide words into syllables and apply spelling rules, we offered them a structured way of thinking about each syllable of the word and we tried to encourage them to actively think about the way to correctly spell words during their spelling activities, which in turn should improve their spelling performance and spelling consciousness. The self-correction condition aimed at having students compare their spelling of words with a model and have them correct the misspelled words by

writing the correct spelling next to the incorrectly spelled word. In the no-correction procedure, students did not receive their dictation sheet back; they received no additional practice. The self-correction and no-correction conditions were used as control conditions because these two procedures are most often used in current spelling education. We hypothesized that students in the strategy-instruction condition will make more progress on both spelling performance and spelling consciousness than students in the self-correction and no-correction condition. Students in the strategy-instruction condition were taught a strategy to improve their spelling performance, but by applying the strategy, they are also forced to think about their spelling, which may improve their spelling consciousness.

We examined both immediate and sustained effects of the three training conditions. Although the training was short (four sessions only) and sustained effects are unlikely to emerge, we nevertheless tested the students five weeks after the training had stopped.

Two additional questions were addressed, namely, whether the effect of the three conditions depend on spelling ability (low- vs. high-skilled spellers) and word characteristics (regularly-spelled vs. loan words). We hypothesized that the effects of the three conditions are the same for low- as for high-skilled spellers. Moreover, we hypothesized that the strategy-instruction condition is more effective for the spelling of regularly-spelled words, since the strategy could only be applied to regular words and not to loan words. With respect to spelling consciousness, we investigated whether the changes in spelling consciousness were caused by changes in criteria rather than knowledge of the correct spelling by using Signal Detection Theory-measures (Macmillan & Creelman, 1991; Stanislaw & Todorov, 1999). Thus, we examined whether sensitivity and response bias changed between pretest, posttest, and retention test. Sensitivity is the proportion of 'yes'-responses written correctly. Response bias is the extent to which a speller might be more likely to respond 'yes' than 'no' or vice versa.

METHOD

Participants

In the present study, 72 third-grade students (39 girls, 33 boys) between the ages of 95 and 122 months ($M = 107.1$, $SD = 5.7$) participated. All students spoke Dutch at school. At home, one student spoke Serbian and one student spoke both Dutch and English. Students were recruited from four classes of two different primary schools. Both schools used the spelling method *Taaljournaal* [*Language News*] (Horst, 1993). This is a method in which spelling rules are classified in different categories. Both schools used the same method, ensuring that all students had learned the same spelling rules and that the rules were taught in the same way.

On the basis of a standardized spelling test (see the Materials section), students were divided, according to a median split, into low-skilled and high-skilled spellers. The 50% lowest-scoring students were classified as low-skilled spellers, and the remaining spellers were classified as high-skilled spellers. Assignment to the three conditions was based on the score on the standardized spelling test, the spelling score on the pretest, the spelling-consciousness score on the pretest, their age, and their sex. The matching procedure resulted in a distribution of the students in the three conditions that did not differ on standardized word spelling, $F(2, 64) = 1.75$, $p = .18$; scores

TABLE 1
Number of Students and Mean Age in the Three Conditions

	No. of participants		*Age (months)*	
Condition	*Girls*	*Boys*	M	SD
Strategy-instruction	16	11	106.6	5.7
Self-correction	10	8	108.1	6.0
No-correction	13	14	106.9	5.7

on experimental spelling, $F(2, 69) = .85$, $p = .43$; scores on spelling consciousness, $F(2, 69) = .01$, $p = 1.00$; age, $F(2, 69) = .43$, $p = .65$; and sex, $F(2, 69) = .33$, $p = .72$.

Both schools had two Grade 3 classes. Students in the strategy-instruction and no-correction condition were from one class, and students in the self-correction condition were from the other class.[1] Table 1 presents the number of boys and girls and their age for each of the three conditions. In our analyses, we included only students who took part in at least two of the four training sessions and who missed no more than one third of the pretest, posttest, or retention test.

Materials

Standardized Spelling Test

We used a standardized spelling-to-dictation test to assess spelling skill: *Schaal Vorderingen in Spellingvaardigheid [Scale Progression in Spelling Abilities]* of van den Bosch, Gillijns, Krom, and Moelands (1991). This test was used to obtain a general indication of the spelling level of the students and contained 36 disyllabic or trisyllabic words at the Grade 3 level. In all dictation tasks, students had to write down the words that were orally presented to them. The lowest possible score was zero and the highest was 36. All scores were converted into percentages.

Words Used in the Pretest, Posttest, and Retention Test[2]

The pretest, posttest, and retention tests contained the same words. The tests consisted of 50 regularly-spelled words and 50 loan words. The order of words was randomized, with the order

[1]In the original design of this study, we had a fourth condition in which students received the same training as in the condition that is now named the *strategy-instruction condition*. However, in this fourth condition, the training was given not to individual students but rather to a group of students. Unfortunately, the Master students who trained the students were not used to teaching a group of students. Despite the extensive instruction they received in how to train the students, it was hard for them to get the students to pay attention during the training. Because of this lack of teaching experience, a large number of the third-grade students were hardly paying attention. Consequently, we decided not to include this condition into the analyses.

[2]At the pretest, posttest, and retention test, students were also individually interviewed about their spelling. They were asked questions about how they evaluated their spelling skills in comparison with their classmates' spelling skills, which steps they used to spell a word (when they knew the word and when they did not know the word), which words were difficult for them, and what they could do to spell words correctly. The trainer just asked these questions, but did not give suggestions regarding how to spell better.

of the pretest being different from that of the posttest, which, in turn, was different from the retention test. Moreover, the list of words was divided in three sections and was administered in three sessions of 34, 33, and 33 words, respectively.

Regularly-spelled words. Spelling performance of regular words was measured by a spelling-to-dictation test based on words from two standardized spelling tests (*Schaal Vorderingen in Spellingvaardigheid*, of van den Bosch et al., 1991, and *PI-dictee*, of Geelhoed and Reitsma, 2004). The test contained 50 words that could be written correctly when students applied the spelling rules they had learned so far in their spelling-education program. The words are presented in Appendix A. The lowest possible score was zero and the highest was 50.

Loan words. As previously stated, non-native Dutch or loan words cannot be spelled correctly by application of spelling rules. The most effective strategy is to learn to know these words by heart or spell them by analogy to other words that are already familiar. This test consisted of 50 loan words that were also used in the study of Paffen and Bosman (2005). The words are presented in Appendix A. The lowest possible score was zero and the highest was 50.

Spelling consciousness. Before writing down each dictated word, spelling consciousness was measured during the pretest, posttest, and retention test. First, students were asked to indicate whether they thought they could write the dictated word correctly or not. Students could do this by circling *yes* when they thought they were able to write the word correctly, and *no* when they thought they were unable to write the word correctly. Next, they were asked to write down the word. Spelling consciousness was computed by counting the number of correct judgments. Responses that contained a *yes* and a correctly written word or a *no* and an incorrectly written word were considered correct. Responses that consisted of a *yes* and an incorrectly written word or a *no* and a correctly written word were considered incorrect. The lowest possible score was zero, and the highest possible score was 50 for regular words and 50 for loan words.

Words Used in the Training Sessions[3]

All students participated in the training sessions, regardless of the condition they were in. The study contained four training sessions of 30 words each. The 120 words used in the training sessions were different from the words used in the pretest, posttest, and retention test. All training words were presented only once. These words were derived from the practice assignments of the same spelling tests as the test words. Again, all regular words could be written correctly when students applied the spelling rules they had learned so far. The training words are presented in Appendix B. For each training session, the lowest possible spelling score was zero and the highest was 30.

[3]Spelling consciousness was measured in each training session as it was measured in the pretest, posttest, and retention test. Before students were instructed to write down a word, they had to indicate whether they thought they could write the word correctly or not.

TABLE 2
Percentage Correct on the Different Tests in the Three Conditions

Condition	*General word spelling*	*Pretest spelling performance*	*Pretest spelling consciousness*
Strategy-instruction			
Mean	78.7	50.7	66.3
SD	16.3	17.5	13.7
Self-correction			
Mean	86.9	57.4	66.1
SD	12.1	14.1	9.0
No-correction			
Mean	79.2	52.4	66.0
SD	16.0	18.5	14.0

Procedure

The test and training sessions were conducted by two Master students. Each Master student tested and trained the students from one school. The Master students received a thorough training and a manual in which the test and training procedures were described in detail. Two weeks after the pretest, the training started. During the following four weeks, students received one training session every week. The posttest was performed the week after the fourth training session, and five weeks after the possttest, the retention test was performed. All spelling-to-dictation tests and training sessions were administered groupwise. Table 2 presents the scores on the tests.

Strategy-Instruction Condition

Students in all three conditions started with a spelling test on the 30 training words in which they first had to indicate whether or not they believed they knew the spelling. Next, the students in the strategy-instruction condition were individually trained. Each student was taken to a separate room in the school and received his or her dictation sheet back. The student was told that all words would be discussed. For each word, the student was asked to segment the word into syllables. For each syllable, the student had to name the spelling rule(s) that had to be applied to write that syllable correctly. When the student was unable to correctly segment the word into syllables or name the particular spelling rule(s), the trainer helped the student. This procedure was repeated for all 30 words. For words that were initially written incorrectly, the student was asked, after segmenting the word into syllables and naming the spelling rule(s), to correct the word by writing the correct spelling next to the incorrectly spelled word.

Self-Correction Condition

After the spelling test on the training words, the students in the self-correction condition were also taken to a room in their school building and received their dictation sheets back. The students were told that they had to correct their work. Each student received a correction sheet that contained all correctly spelled words of that training session. The trainers did not check whether

or not the students corrected all words. The self-correction was not directly after the dictation session. This condition was administered groupwise, students had to perform the self-correction procedure by themselves, without the help of the teacher. It was, therefore, not necessary to use individual sessions for the self-correction condition.

No-Correction Condition

After the spelling test on the training words, the students in this condition received no further training and they were not handed back their dictation sheets.

RESULTS

We first examined the immediate effects of the different conditions with respect to spelling performance and spelling consciousness. Second, the sustained effects of the different conditions were examined with respect to spelling performance and spelling consciousness. We examined whether the effects of the three conditions remained stable between posttest and retention test. Then, we investigated whether there were overall effects of the three conditions between pretest and retention test. For both the immediate and sustained effects, additional questions were whether the influences of the three conditions depended on spelling ability (low-skilled spellers vs. high-skilled spellers) and word characteristics (regular words vs. loan words). With respect to spelling consciousness, we also checked whether the changes in spelling consciousness were caused by changes in sensitivity and/or response bias. Difference scores were used as an indicator for change in performance of the students between pretest and posttest (regarding immediate effects), posttest and retention test, and pretest and retention test (both regarding sustained effects). We chose difference scores to correct for pretest differences, albeit these were not significant and applied Bonferroni corrections to all analyses.

Immediate Effects of the Three Different Conditions

Spelling Performance

To examine whether students made more progress in their spelling performance when they were taught a spelling strategy, had to self-correct their dictation, or received no instruction at all, a general linear model procedure for repeated measures was conducted in a 2 (speller: high-skill vs. low-skill) $\times$ 3 (condition: strategy instruction vs. self-correction vs. no correction) $\times$ 2 (word characteristic: regular vs. loan) design on the difference between pretest and posttest. Speller and condition were treated as between-subjects variables, and word characteristic was treated as a within-subjects variable. The difference scores of the students in the three conditions are presented in Table 3.

The analyses indicated that neither the three-way interaction between speller, condition, and word characteristic, $F(2, 66) = 1.24$, $p = .30$, nor the two-way interactions between condition and speller, $F(2, 66) = 1.66$, $p = .20$, or between condition and word characteristic, $F(2, 66) = 2.92$, $p = .06$, reached significance. The main effects of speller and word characteristic were significant, but these effects warranted further qualification because of the significant two-way

TABLE 3
Difference Scores for Spelling Performance on the Different Words in the Three Conditions (%)

	Low-skilled speller						*High-skilled speller*					
	Strategy-instruction		*Self-correction*		*No-correction*		*Strategy-instruction*		*Self-correction*		*No-correction*	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Posttest – Pretest												
All	7.2	5.3	7.4	6.5	4.3	5.9	6.3	4.7	2.3	2.6	0.4	3.7
Regular	9.1	8.1	17.4	16.6	7.1	11.3	4.6	7.4	1.7	5.9	–2.0	4.6
Loan	5.2	6.9	0.0	5.7	1.3	5.0	8.1	5.1	2.9	4.5	2.7	7.3
Retention Test – Posttest												
All	2.6	4.2	–0.9	4.9	2.3	4.2	1.4	4.1	2.6	3.9	4.3	3.0
Regular	0.5	8.1	–5.7	7.1	3.6	6.7	1.1	5.5	2.5	2.7	1.2	3.9
Loan	5.0	3.7	4.0	9.7	1.2	4.7	1.6	6.2	2.6	6.2	7.3	4.5
Retention Test – Pretest												
All	9.8	6.4	6.6	5.0	6.6	7.6	7.7	5.1	4.8	4.3	4.6	3.3
Regular	9.5	9.5	11.7	14.2	10.8	13.9	5.7	7.7	4.2	6.2	–0.8	3.2
Loan	10.2	7.9	4.0	5.7	2.5	6.0	9.7	7.1	5.5	4.1	10.0	7.2

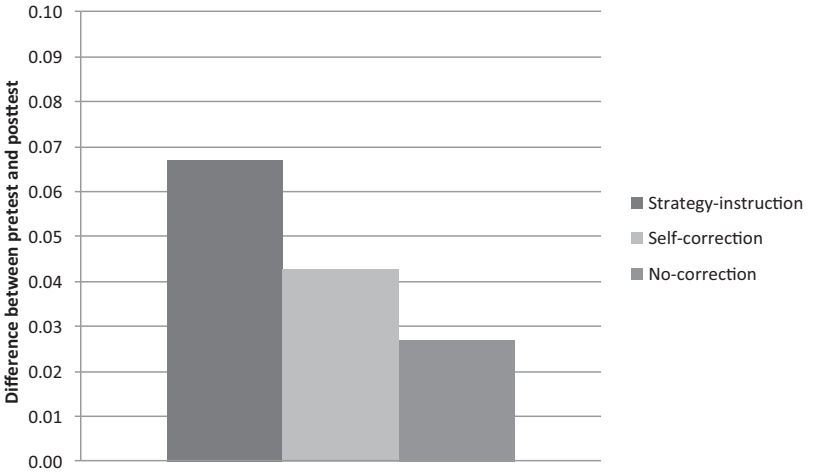

FIGURE 1 Progress in spelling performance between pretest and posttest.

interaction effect between speller and word characteristic, $F(1, 66) = 18.56$, $p < .0001$, partial $\eta^2 = .22$. Because this effect was not considered relevant for the aim of the present study, we do not further discuss it.

The main effect of condition was significant, $F(2, 66) = 5.38$, $p < .01$, partial $\eta^2 = .14$. Subsequent post-hoc tests revealed that students in the strategy-instruction condition made more progress between pretest and posttest than students in the no-correction condition ($p < .01$). No differences existed between students in the strategy-instruction and self-correction condition ($p = 1.00$) or between students in the self-correction and no-correction condition ($p = .13$). This is also shown in Figure 1.

Additional t tests showed that students in all three conditions made progress between pretest and posttest, respectively, strategy-instruction, $t(26) = -7.09$, $p < .0001$, Cohen's $d = .39$; self-correction, $t(17) = -3.60$, $p < .01$, Cohen's $d = .33$; and no-correction condition, $t(26) = -2.61$, $p < .05$, Cohen's $d = .16$. However, the strategy-instruction condition was most effective for the improvement in spelling performance between pretest and posttest.

Spelling Consciousness

With respect to spelling consciousness, a similar general linear model procedure for repeated measures was conducted, as described earlier, but now on the difference in spelling consciousness between pretest and posttest. The difference scores of the students in the three conditions are presented in Table 4.[4] The analyses indicated that neither the three-way interaction between speller, condition and word characteristic, $F(2, 66) = 2.64$, $p = .08$, nor the two-way interaction between condition and speller reached significance, $F(2, 66) = .27$, $p = .76$. The main effect of word characteristic was significant, but this effect warranted further qualification because of the

[4]The spelling consciousness of students in all three conditions did not increase between pretest and posttest: strategy-instruction, $t(26) = -1.46$, $p = .16$; self-correction, $t(17) = -.23$, $p = .82$; no-correction, $t(26) = 1.42$, $p = .17$.

TABLE 4
Difference Scores for Spelling Consciousness on the Different Words in the Three Conditions (%)

	Low-skilled speller						*High-skilled speller*					
	Strategy-instruction		*Self-correction*		*No-correction*		*Strategy-instruction*		*Self-correction*		*No-correction*	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Posttest – Pretest												
All	2.7	11.7	–0.4	9.7	–4.4	12.3	2.5	6.5	1.0	7.4	–0.7	7.5
Regular	3.7	9.6	13.4	10.8	4.5	10.1	1.6	8.5	1.0	9.6	0.4	6.9
Loan	1.8	17.4	–14.4	19.1	–13.3	20.7	3.3	7.1	1.0	12.9	–1.9	13.3
Retention Test – Posttest												
All	−2.1	12.6	−2.7	6.9	−0.3	6.4	2.6	4.3	2.7	5.3	2.8	2.7
Regular	−1.2	12.2	−5.1	7.0	−1.7	8.5	2.1	6.5	3.6	6.1	1.6	4.0
Loan	−3.0	18.1	−0.3	12.7	1.1	10.8	3.3	7.2	1.8	8.9	4.1	6.4
Retention Test – Pretest												
All	0.6	10.1	−3.1	15.4	−4.7	13.9	5.1	7.2	3.7	8.9	2.1	6.9
Regular	2.5	9.8	8.3	7.5	2.8	14.1	3.7	9.7	4.6	5.4	1.9	8.2
Loan	−1.2	17.2	−14.7	28.6	−12.2	21.8	6.6	11.4	2.8	14.8	2.2	14.8

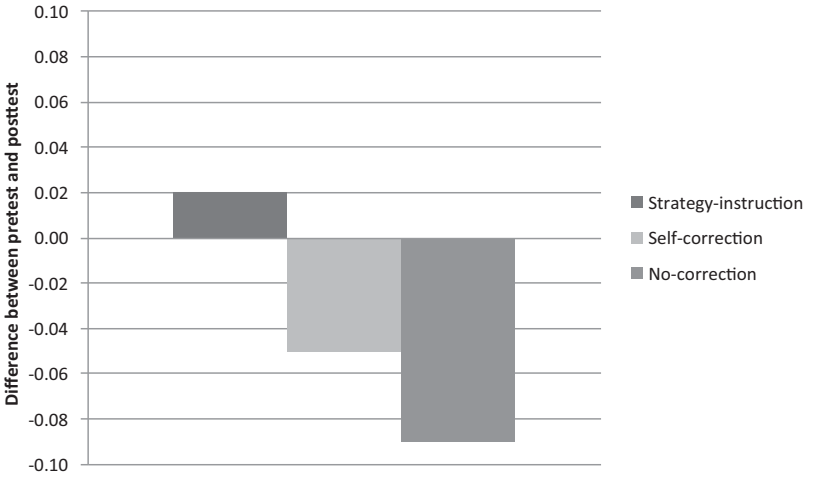

FIGURE 2 Progress in spelling consciousness between pretest and posttest for loan words.

significant two-way interactions between speller and word characteristic, $F(1, 66) = 13.86$, $p < .0001$, partial $\eta^2 = .17$, and between condition and word characteristic, $F(2, 66) = 3.92$, $p < .05$, partial $\eta^2 = .11$.

We are mainly interested in the interaction between condition and word characteristic. We further analyzed this interaction by focusing on the difference between the three conditions for regular words and loan words separately. Subsequent analyses of variance revealed that for regular words, progress between pretest and posttest did not differ among the three conditions, $F(2, 69) = .70$, $p = .50$. However, as shown in Figure 2, for loan words, the change in spelling consciousness between pretest and posttest was different for students in the strategy-instruction condition than for students in the no-correction condition, $F(2, 69) = 3.31$, $p < .05$, partial $\eta^2 = .09$. No differences existed between students in the self-correction and no-correction condition ($p = 1.00$), or between students in the strategy-instruction and self-correction condition ($p = .84$). Additional t tests showed that the spelling consciousness of students in the no-correction condition decreased, $t(26) = 2.24$, $p < .05$, whereas that of students in the strategy-instruction, $t(26) = -1.03$, $p = .31$, and self-correction condition, $t(17) = 1.25$, $p = .23$, did not change between pretest and posttest. Thus, for regular words, there were no differences in progress in spelling consciousness between pretest and posttest between the three conditions. For loan words, students in the no-correction condition had a decrease in spelling consciousness, whereas the spelling consciousness of students in the strategy-instruction condition remained stable.

Sustained Effects of the Three Different Conditions

Spelling Performance

With respect to the sustained effects of spelling performance, we conducted a similar general linear model procedure for repeated measures, as previously described, but now on the difference

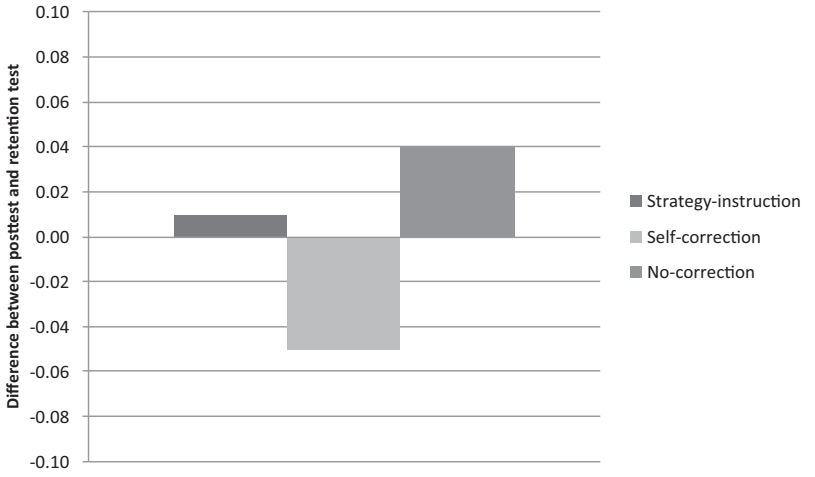

FIGURE 3 Progress in spelling performance of low-skilled spellers between posttest and retention test for regular words.

between posttest and retention test, and thereafter on the difference between pretest and retention test. The difference scores of the students in the three conditions are presented in Table 3.

Posttest versus retention test. The three-way interaction between speller, condition, and word characteristic was significant, $F(2, 66) = 7.01$, $p < .01$, partial $\eta^2 = .18$. We further analyzed this interaction by focusing first on regular words, and thereafter on loan words. For regular words, there was a difference between the conditions for low-skilled spellers, $F(2, 33) = 3.99$, $p < .05$, partial $\eta^2 = .20$. As shown in Figure 3, the change in spelling performance between posttest and retention test was different for low-skilled spellers in the self-correction condition than for low-skilled spellers in the no-correction condition ($p < .05$). No differences existed between low-skilled spellers in the no-correction and strategy-instruction condition ($p = .76$) or between low-skilled spellers in the self-correction and strategy-instruction condition ($p = .24$). Additional t tests showed that the spelling performance of low-skilled spellers in the no-correction condition increased, $t(15) = –2.18$, $p < .05$, whereas that of low-skilled spellers in the self-correction, $t(6) = 2.14$, $p = .08$, and strategy-instruction condition did not change between posttest and retention test, $t(12) = –.21$, $p = .84$. For high-skilled spellers, there was no difference between the three conditions, $F(2, 33) = .34$, $p = .72$.

For loan words, there were no differences between the three conditions for low-skilled spellers, $F(2, 33) = 1.73$, $p = .19$, but there were differences for high-skilled spellers, $F(2, 33) = 3.32$, $p < .05$, partial $\eta^2 = .17$. This is shown in Figure 4. Subsequent post-hoc tests showed that the scores of spellers in the no-correction condition increased more between posttest and retention test than the scores of spellers in the strategy-instruction condition ($p = .06$). No differences existed between spellers in the self-correction and no-correction condition ($p = .19$) or between spellers in the strategy-instruction and self-correction condition ($p = 1.00$). Additional t tests showed that only the spelling performance of high-skilled spellers in the no-correction condition increased between posttest and retention test, $t(10) = –5.36$, $p < .0001$, in contrast to spellers

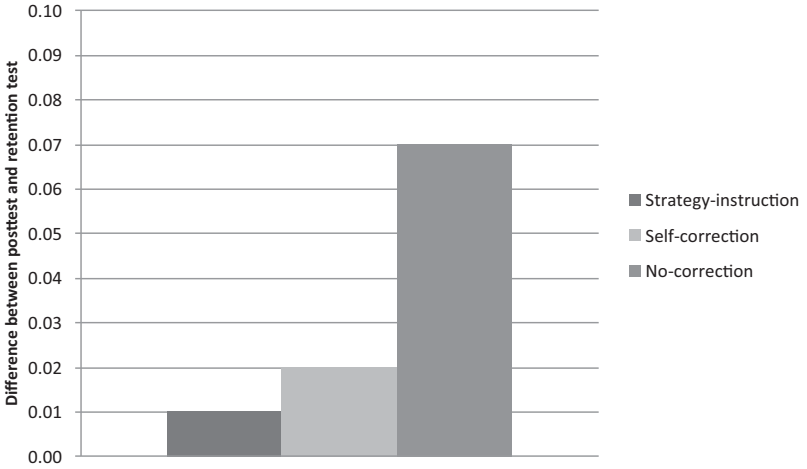

FIGURE 4 Progress in spelling performance of high-skilled spellers between posttest and retention test for loan words.

in the strategy-instruction, $t(13) = –0.95$, $p = .36$, and self-correction condition, $t(10) = –1.36$, $p = .20$.

Pretest versus retention test. The analyses indicated that neither the three-way interaction between speller, condition, and word characteristic, $F(2, 66) = 3.03$, $p = .06$, nor the two-way interactions between condition and speller, $F(2, 66) = .04$, $p = .96$, or condition and word characteristic, $F(2, 66) = 1.25$, $p = .30$, or the main effects of condition, $F(2, 66) = 2.05$, $p = .14$, speller, $F(1, 66) = 2.76$, $p = .10$, or word characteristic, $F(1, 66) = .01$, $p = .92$ reached significance. The two-way interaction effect between speller and word characteristic did reach significance, $F(1, 66) = 13.29$, $p < .01$, *partial* $\eta^2 = .17$. However, this effect was not considered relevant for the aim of the present study.

To summarize, between posttest and retention test, there were no differences in progress in spelling performance between the three conditions for the spelling of regular words by high-skilled spellers and the spelling of loan words by low-skilled spellers. For the spelling of regular words by low-skilled spellers, the spelling performance increased only for spellers in the no-correction condition; spellers in this condition made significantly more progress than spellers in the self-correction condition. For the spelling of loan words by high-skilled spellers, the spelling performance increased only for spellers in the no-correction condition; spellers in this condition made significantly more progress than spellers in the strategy-instruction condition. Between pretest and retention test, there were no differences in progress in spelling performance between the three conditions.

Spelling Consciousness

Posttest versus retention test. With respect to the sustained effects of spelling consciousness, a similar general linear model procedure for repeated measures was conducted as described

above, but now on the difference between posttest and retention test, and thereafter on the difference between pretest and retention test. The difference scores of the students in the three conditions are presented in Table 4.

The analyses indicated that neither the three-way interaction between speller, condition and word characteristic, $F(2, 66) = .68$, $p = .51$, nor the two-way interactions between condition and speller, $F(2, 66) = .15$, $p = .86$, condition and word characteristic, $F(2, 66) = .34$, $p = .72$, and speller and word characteristic, $F(1, 66) = .15$, $p = .70$, or the main effects of condition, $F(2, 66) = .20$, $p = .82$, and word characteristic, $F(1, 66) = .64$, $p = .43$, reached significance. The main effect of speller was significant, $F(1, 66) = 6.35$, $p < .05$, partial $\eta^2 = .09$, indicating that high-skilled spellers made more progress than low-skilled spellers.

Pretest versus retention test. The analyses indicated that neither the three-way interaction between speller, condition, and word characteristic, $F(2, 66) = .75$, $p = .48$, nor the two-way interactions between condition and speller, $F(2, 66) = .10$, $p = .91$, and condition and word characteristic, $F(2, 66) = 1.96$, $p = .15$, or the main effect of condition, $F(2, 66) = 1.05$, $p = .35$, reached significance. The two-way interaction between speller and word characteristic was significant, $F(1, 66) = 8.68$, $p < .01$, partial $\eta^2 = .12$, but this effect was not considered relevant for the aim of the present study.

Thus, both between posttest and retention test, and between pretest and retention test, there were no differences in the influence of the three conditions on spelling consciousness.

Sensitivity and Response Bias

Sensitivity

To examine whether changes in spelling consciousness were due to changes in the sensitivity, we used the Signal Detection Theory (Macmillan & Creelman, 1991; Stanislaw & Todorov, 1999). First, we had to use an adjustment value of 0.5 in each cell because some spellers had zero responses in one or more of the four cells (i.e., yes-correct, yes-incorrect, no-correct, and no-incorrect) for both regular and loan words at the pretest, posttest, and retention test. Second, we computed the percentage of hit rates (number of yes-correct responses divided by the total number of correctly written words) and false-alarm rates (number of yes-incorrect responses divided by the total number of incorrectly written words). Table 5 presents the hit and false-alarm rates for spellers in all three conditions. Third, we computed the sensitivity index *d'* by subtracting the z scores of the false-alarm rates from the z scores of the hit rates. Fourth, we conducted a general linear model procedure for repeated measures in a 3 (condition: strategy instruction vs. self-correction vs. no correction) × 2 (word characteristic: regular vs. loan) × 3 (time: pretest vs. posttest vs. retention test) design on the *d'* scores. Condition was treated as a between-subjects variable, and word characteristic and time were treated as within-subjects variables.

The analyses indicated that neither the three-way interaction between condition, word characteristic, and time, $F(4, 138) = .22$, $p = .93$, nor the two-way interactions between condition and word characteristic, $F(2, 69) = .04$, $p = .96$, condition and time, $F(4, 138) = .20$, $p = .94$, and word characteristic and time, $F(2, 138) = .005$, $p = 1.00$, or the main effects of condition, $F(2, 69) = 2.09$, $p = .13$, word characteristic, $F(1, 69) = .002$, $p = .97$, and time, $F(2, 138) = .01$, $p = .99$, reached significance. Thus, changes in spelling consciousness were not due to changes in

TABLE 5
Percentages of Hit and False-Alarm Rates in Each Condition

	Strategy-instruction				*Self-correction*				*No-correction*			
	Hit rate		*False-alarm rate*		*Hit rate*		*False-alarm rate*		*Hit rate*		*False-alarm rate*	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Pretest												
Regular	89.3	13.8	73.3	20.1	93.6	9.9	83.8	11.5	86.9	18.2	75.7	18.0
Loan	81.4	20.3	56.9	29.6	86.8	11.1	68.8	26.1	75.4	22.4	54.8	29.3
Posttest												
Regular	88.5	13.8	72.8	20.9	97.0	5.4	87.1	13.1	93.3	12.5	84.6	15.1
Loan	76.1	21.7	53.2	33.8	88.9	14.6	74.1	21.5	82.4	19.6	69.9	23.5
Retention test												
Regular	88.9	17.2	74.2	22.3	97.8	1.8	86.9	10.3	92.0	17.8	81.5	21.4
Loan	79.8	21.9	56.8	32.5	92.2	10.2	80.0	23.0	82.2	21.4	69.8	28.8

the sensitivity between the pretest, posttest, and retention test, because the sensitivity remained stable over time, word characteristic, and condition.

Response Bias

To examine whether changes in spelling consciousness were due to changes in response bias, we used the Signal Detection Theory (Macmillan & Creelman, 1991; Stanislaw & Todorov, 1999). The computation of the hit and false-alarm rates was already described earlier. We computed the response bias c by averaging the z scores of the hit rates and the false-alarm rates. To obtain values to signify that values of c that are larger than zero signify a bias toward *no-responses*, whereas values of c that are smaller than zero signify a bias toward *yes-responses*, we multiplied the average z scores by –1. Thereafter, we conducted a general linear model procedure for repeated measures in a same design as described earlier for sensitivity.

The analyses indicated that neither the three-way interaction between condition, word characteristic, and time, $F(4, 138) = .36$, $p = .84$, nor the two-way interactions between condition and word characteristic, $F(2, 69) = .24$, $p = .79$, and word characteristic and time, $F(2, 138) = .01$, $p = .99$, or the main effect of word characteristic, $F(1, 69) = .001$, $p = .98$, reached significance. The main effects of condition and time were significant, but these effects warranted further qualification, because of the significant two-way interaction between condition and time, $F(4, 138) = 2.96$, $p < .05$, partial $\eta^2 = .08$. We further analyzed this interaction by focusing on the change in c over time for each condition separately. Subsequent general linear model analyses for repeated measures revealed that there were no changes in c over time between the pretest, posttest, and retention test for all three conditions, respectively, strategy-instruction, $F(2, 52) = 2.74$, $p = .07$, self-correction, $F(2, 34) = .08$, $p = .93$, and no-correction, $F(1.40, 36.38) = 2.76$, $p = .09$.

Subsequent analyses of variance revealed no differences in c between the three conditions at the pretest, $F(2, 69) = 1.86$, $p = .16$. However, as shown in Figure 5, at the posttest, there were differences in c between the three conditions, $F(2, 69) = 4.27$, $p < .05$, partial $\eta^2 = .11$. The c value of students in the strategy-instruction condition was different from that of students in

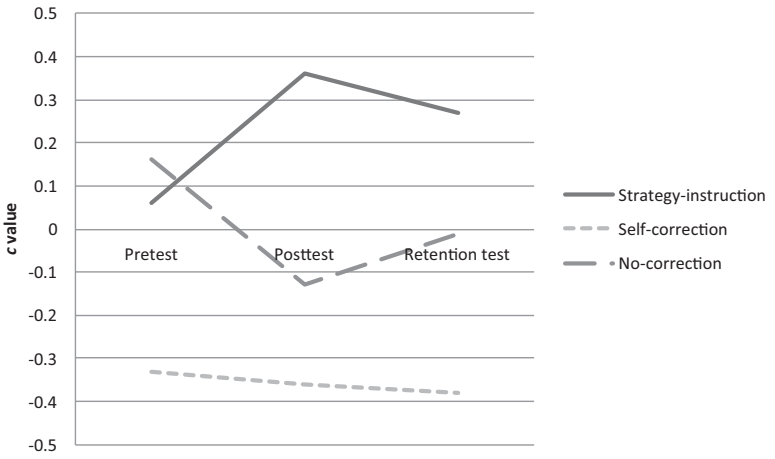

FIGURE 5 *C* values at the pretest, posttest, and retention test.

the self-correction condition ($p < .05$). No differences existed between students in the strategy-instruction and no-correction condition ($p = .12$) or between students in the self-correction and no-correction condition ($p = 1.00$). Subsequent t tests showed that the negative c value of students in the self-correction condition was deviant from zero, $t(17) = -2.53, p < .05$, whereas the c values of students in the strategy-instruction, $t(26) = 1.84$, $p = .08$, and no-correction condition were not deviant from zero, $t(26) = -.81$, $p = .43$. Thus, students in the strategy-instruction condition had no bias, whereas students in the self-correction condition had a bias toward *yes-responses*.

At the retention test, as shown in Figure 5, there were also differences in c between the three conditions, $F(2, 69) = 3.18$, $p < .05$, partial $\eta^2 = .08$. Again, the c value of students in the strategy-instruction condition was different from that of students in the self-correction condition ($p < .05$). No differences existed between students in the strategy-instruction and no-correction condition ($p = .69$) or between students in the self-correction and no-correction condition ($p = .47$). Subsequent t tests showed that the negative c value of students in the self-correction condition was deviant from zero, $t(17) = -4.30$, $p < .0001$, whereas the c values of students in the strategy-instruction, $t(26) = 1.45$, $p = .16$; and no-correction condition were not deviant from zero, $t(26) = -.07$, $p = .95$. Thus, at both the posttest and retention test, students in the strategy-instruction condition had no bias, whereas students in the self-correction condition had a bias toward *yes-responses*.

DISCUSSION

The present study examined how spelling performance and spelling consciousness can be improved by a spelling training. We compared the immediate and sustained effects of three different training conditions on both the spelling performance and spelling consciousness of third grade spellers. All students received a training that consisted of four dictation sessions in which students first had to indicate whether they were able to write the word correctly or not and thereafter had to write the word down. After each dictation session, students received one of three forms of training. In the strategy-instruction condition, students were taught a strategy to correct their work, in which they had to divide each word into syllables and had to name the spelling rules that had to be applied to each syllable. In the self-correction condition, students were instructed to correct their work with the help of a correction sheet. The trainer did not check whether students really corrected all of their errors, but it appeared that students corrected almost all of their misspelled words, only about 7% of the misspelled words were not corrected. When students corrected their misspelled words, most of the time, they spelled the new word correctly. In the no-correction condition, students did not receive any further instruction or training.

Immediate Effects

Spelling Performance

With respect to the immediate effects of the different training conditions on spelling performance, the strategy instruction condition was most effective. The positive effect of strategy instruction on spelling performance is in line with our hypothesis and with previous research (Butyniec-Thomas & Woloshyn, 1997; Kernaghan & Woloshyn, 1995; Paffen & Bosman, 2005; Willemen et al., 2000, 2002). These studies also showed that teaching students a structured way

to spell words leads to positive outcomes for their spelling performance. The strategy in our study focused both on syllable segmentation and teaching spelling rules. Various studies confirm the effect of syllable segmentation (Butyniec-Thomas & Woloshyn, 1997; Kernaghan & Woloshyn, 1995; Paffen & Bosman, 2005) and the teaching of spelling rules (Butyniec-Thomas & Woloshyn, 1997; Paffen & Bosman, 2005). The present study showed that strategy instruction was effective for both low- and high-skilled spellers, an effect that was also found by Paffen and Bosman (2005). Strategy instruction was also effective for both regular and loan words.

Spelling Consciousness

With respect to the immediate effects of the different training conditions on spelling consciousness, the strategy-instruction condition was more effective than the no-correction condition for the writing of loan words. Students in the no-correction condition had a decrease in spelling consciousness between the pretest and the posttest, whereas the spelling consciousness of students in the strategy-instruction condition remained stable. An explanation might be that students in the strategy-instruction condition may have become more aware of their spelling during the writing of words because they had to apply the strategy to each word. They might have been encouraged to think some more about their spelling during the spelling process than students in the no-correction condition. Students in the no-correction condition were not encouraged to think some more about their spelling, and they might be more inclined to overestimate their spelling ability.

Moreover, because students in the no-correction condition had to indicate the correctness of their spellings 320 times, without receiving the opportunity to check whether their indication was correct, they may have been less motivated to accurately indicate the correctness of their spellings. This might have resulted in more often circling *yes*, without proper thinking about the correctness of their spelling. Students who had the opportunity to check whether their indication was correct, may have been more motivated to accurately indicate the correctness of their spellings. This explanation is supported by the fact that students in the no-correction condition had a higher false-alarm rate at the posttest than at the pretest, whereas the false-alarm rate in the other two conditions remained stable between pretest and posttest. An explanation for the fact that this difference between the strategy-instruction and no-correction condition was only visible for loan words is that students made more errors on loan words than on regular words, thus an overestimation of the spelling ability would have had more effect on the spelling consciousness scores on loan words than on regular words.

These findings are in line with our hypothesis and with the findings of Paffen and Bosman (2005). They found that only students who received the training were better at indicating which words they could not spell correctly. It is important for students to know which words are difficult for them, because then they can pay extra attention to those words, ask the teacher for help, and, even more importantly, they can work on these difficulties.

Sustained Effects

Spelling Performance

As we expected, the positive effect of the strategy-instruction condition faded out after the training stopped. Between the posttest and the retention test, for low-skilled spellers, the spelling

performance of regular words increased only for students in the no-correction condition. Spellers in the no-correction condition made significantly more progress than spellers in the self-correction condition. For high-skilled spellers, the spelling performance of loan words increased only for students in the no-correction condition. These spellers made significantly more progress than students in the strategy-instruction condition. However, the overall effect between the pretest and the retention test showed that there were no differences in progress in spelling performance between the three conditions.

This provides evidence for the importance of spelling instruction, even for high-skilled spellers. After the spelling training had stopped, the positive effect had faded out. A possible explanation is that, according to our expectations, only four strategy-instruction sessions is not enough for third grade students to internalize the strategy and to apply it after the training stopped.

Spelling Consciousness

Again, as expected, the effects of the training conditions disappeared after the training had stopped. Between the posttest and the retention test, and between the pretest and the retention test, there were no differences in the influence of the three conditions on spelling consciousness.

Again, these results showed evidence for the importance of instruction, and especially strategy instruction, for students to improve their spelling consciousness. This is not only confirmed by the fact that the spelling consciousness of loan words of students in the strategy-instruction condition remained stable, whereas that of students in the no-correction condition, in which they received no instruction, decreased, but also because after the posttest, the strategy-instruction condition was no more effective than the no-correction condition anymore.

That the sustained effects of spelling-consciousness were the same for the three conditions, might be explained by the large amount of experience with judging the own spelling of students in all three conditions. All students had to judge their spelling in the pretest, training sessions, posttest, and retention test, which means they had to judge the spelling of 420 words. The positive effect of judging one's own spelling on spelling consciousness was also mentioned in the study of Paffen and Bosman (2005). In their study, the students in the control group also improved their spelling consciousness, most likely as a result of the judgments made during the test sessions.

The results of the Signal Detection Theory measures showed that changes in spelling consciousness were not due to changes in the sensitivity between the pretest, posttest, and retention test. The bias toward *yes* or *no* was the same for the three conditions at the pretest. However, at the posttest and retention test, students in the strategy-instruction condition had no bias, whereas students in the self-correction condition had a bias toward *yes-responses*. This indicates that strategy instruction may lead to more accurate judgments than self-correction.

The data on the percentage of judgments in each spelling-consciousness category revealed that spellers did not make valid *no-responses* on regular words before training. When they predicted that they did not know how to spell the word, they were as likely to be correct as incorrect. However, on loan words they were quite accurate. Note, however, that the difference in spelling consciousness between loan words and regular words was not just due to the fact that they were less familiar with loan words. Students knew the meaning of most loan words, and when they did not, the meaning was explained by the experimenter. Moreover, there were also regular words with which students were not very familiar or which they had never written before. The fact that students can hear that loan words have different sounds than prototypical Dutch words was

demonstrated by Sap and Bosman (2008). In their study, second grade students were already able to indicate which words were originally Dutch and which words were derived from another language.

Self-confidence may have had an influence on the development in spelling consciousness. Spellers with a low self-confidence may have fewer *yes-correct* and more *no-correct* judgments than spellers with an average self-confidence. One might say that it is this confidence that increases during training. Indeed, the basic data show that the percentage of *yes-correct* judgments increased over time, whereas the percentage of *no-incorrect* decreased over time. This suggests that it is self-confidence that increased during training. However, it is not only self-confidence that causes the development in spelling consciousness, because on loan words, the percentage of *no-correct* judgments increased rather than decreased during training. Thus, confidence may have some influence on spelling consciousness, it does not explain all of the effects.

To summarize, with respect to the immediate effects of the training both on spelling performance and spelling consciousness, the strategy-instruction condition was most effective. With respect to the sustained effects, as was expected, the effects of strategy-instruction training faded out after the training stopped. This revealed the transient nature of the changes in spelling performance induced by the instructional manipulations in our study. More training sessions are probably required to find sustained effects after the training stopped.

Practical Implications

Our study showed that both spelling performance and spelling consciousness can be improved by a short spelling training. The effects in our study are relatively small, because it was only an experimental study that consisted of four training sessions only; it is unrealistic to expect that four sessions are sufficient for spellers to internalize the strategy that was taught. However, the fact that effects occurred after only four training sessions is a strong indication that strategy instruction might be very effective when it is incorporated in spelling education. Since higher levels of spelling consciousness go along with higher levels of spelling performance,[5] it is useful to incorporate training on spelling consciousness in spelling instruction. The findings of the present study confirmed previous research that indicated the importance of proper spelling instruction. We showed the positive effects of our short training, but also the transient nature of the improvement in spelling performance induced by the training, in that positive effects decline after the training had stopped.

For clinical practice, this means that teachers should pay sufficient attention to proper spelling instruction that focus on both spelling performance and spelling consciousness. Spelling performance and spelling consciousness can be improved by teaching students a spelling strategy that offers them a structured way to spell words. An effective strategy is to have students segment words into syllables and let them think of the spelling rules that can be applied to each syllable. Both low- and high-skilled spellers need instruction and experience in both aspects of spelling. More important, instruction requires permanent attention both on spelling performance and spelling consciousness.

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[5]In additional analyses, we established that spelling performance and spelling consciousness were related in our study at the pretest ($r = .65$, $p < .0001$), posttest ($r = .77$, $p < .0001$), and retention test ($r = .86$, $p < .0001$). High spelling performance went along with high spelling consciousness, and vice versa.

AUTHOR NOTES

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APPENDIX A

Words Used in the Pretest, Posttest, and Retention Test

Regularly spelled words	*Loan words*
brandnetels [nettles]	ruïne [ruins]
smokkelaars [smugglers]	explosie [explosion]
voetballer [soccer player]	theater [theater]
stromen [streams]	lucifer [match]
schaduw [shadow]	fantastisch [fantastic]
sneeuwmannen [snowmen]	exotisch [exotic]
bericht [message]	orthodontist [orthodontist]
kastdeur [door of a closet]	bureau [desk]
beloning [reward]	chirurg [surgeon]
broodtrommel [bread box]	bibliotheek [library]
vogeltjes [little birds]	computer [computer]
verlegen [shy]	champignons [mushrooms]
koffertje [little suitcase]	plafond [ceiling]
vleesgerecht [meat-course]	maximum [maximum]
tomaten [tomatoes]	charmant [charming]
hoofdletter [capital]	ambulance [ambulance]
boterhammen [slices of bread]	spaghetti [spaghetti]
meeuwen [gulls]	illustratie [illustration]
krokodillen [crocodiles]	politie [police]
hardloper [runner]	cadeau [gift]

(*Continued on next page*)

Words Used in the Pretest, Posttest, and Retention Test (*Continued*)

Regularly spelled words	*Loan words*
fluitketel [singing teakettle]	machinist [train driver]
getallen [numbers]	hobby [hobby]
oppassen [taking care]	centrum [center]
brutaal [rude]	taxi [taxi]
schreeuw [scream]	hallucinatie [hallucination]
ongeveer [approximately]	cheque [cheque]
slaapzalen [dormitories]	liniaal [ruler]
fakkeloptocht [torch ceremony]	etalagepop [window dummy]
stoppelbaard [stubbly beard]	garagepoort [garage gate]
schommel [swing]	cirkel [circle]
vriendschap [friendship]	echo [echo]
verzameling [collection]	benzine [gasoline]
roeiers [rowers]	marathon [marathon]
zweefmolen [giant's stride]	apotheek [pharmacy]
kieuwen [gills]	punaise [thumbtack]
voorzitter [chairman]	romantisch [romantic]
toestemming [permission]	bioscoop [cinema]
weerverswachting [weather forecast]	meubilair [furniture]
bedankt [thanks]	centrifuge [centrifuge]
zelfbeheersing [self-control]	niveau [level]
bekeuring [penalty]	accommodatie [accomodation]
enkel [ankle]	architect [architect]
lawaai [noise]	journalist [journalist]
waterdruppels [drops of water]	uniform [uniform]
volwassenen [adults]	typen [to type]
oorverdovend [deafening]	export [export]
ademhaling [breath]	asperges [asparagus]
mooiste [prettiest]	expositie [exposition]
verfkwast [paintbrush]	emigratie [emigration]
gastspreker [guest speaker]	horloge [watch]

APPENDIX B

Words Used in the Training Sessions

Session 1	*Session 2*	*Session 3*	*Session 4*
regen [rain]	bakker [baker]	spuit [injection needle]	sprinkhanen [grasshoppers]
schatkist [treasure chest]	tevreden [satisfied]	verkeerslicht [traffic-light]	veldmuis [field mouse]
kralen [pellets]	zwaai [sway]	ballonnen [balloons]	samenkomst [meeting]
kreeft [lobster]	strandhut [beach cabin]	hagelslag [chocolate sprinkles]	gehaktballen [meatballs]
avonturen [adventures]	middelen [means]	kippenhok [hennery]	kantoren [offices]
angst [fear]	opnieuw [again]	brandstichter [arsonist]	kroketten [croquettes]
kassa [pay desk]	rugzakken [backpacks]	hobbelpaard [rocking horse]	schelpen [shells]
woord [word]	luchtballon [balloon]	mededeling [announcement]	evenwicht [balance]
vlokken [flakes]	bedlampje [bed lamp]	oktober [October]	geschrokken [frightened]
tovenaar [wizard]	kastelen [castles]	oppervlakte [surface]	bestemming [destination]
mond [mouth]	koektrommel [cookies box]	samen [together]	angstdromen [nightmares]
opener [opener]	kamerplanten [indoor plants]	schatkamer [treasury chamber]	kennissen [acquaintances]
pennen [pens]	broodplank [bread board]	slaapkamer [bedroom]	slangen [snakes]
schepen [ships]	bedden [beds]	vergissing [mistake]	opvallend [remarkable]
handbal [handball]	verhalen [stories]	aardbeving [earthquake]	tekeningen [drawings]
geweer [gun]	teleurstelling [disappointment]	drinkwater [drinking water]	zangvogel [singing-bird]
paraplu [umbrella]	rondvaart [circular cruise]	gebaren [gestures]	voorstellingen [exhibitions]
oplichters [swindlers]	petten [caps]	kammetje [little brush]	voetstappen [footsteps]
appelstroop [apple treacle]	personen [people]	melktand [primary tooth]	verkeerd [wrong]
boerinnen [farmer's wives]	spannend [exciting]	nieuwsbrief [news letter]	brand [fire]
vuist [fist]	ondeugend [naughty]	overdag [by day]	leeuwinnen [lionesses]
verschillen [differences]	kantoortje [small office]	prinsessen [princesses]	ogenblikje [moment]
stekelvarken [porcupine]	kannetje [cannikin]	middelpunt [centre]	belangstelling [interest]
spelletje [game]	beweging [movement]	optocht [procession]	onverstoorbaar [imperturbable]
sneeuwstorm [blizzard]	brillen [pairs of glasses]	soldaten [soldiers]	ongelukken [accidents]
broodkorst [bread crust]	garnalen [shrimps]	spoorloos [trackless]	verpleger [nurse]
fietszadel [bike saddle]	geschreeuw [yelling]	spreeuwen [starlings]	uitstekend [excellent]
geeuw [yawn]	gespetter [splash]	springstoffen [explosives]	vloeistoffen [fluids]
komkommer [cucumber]	vertrokken [departed]	pudding [pudding]	woning [home]
vanzelfsprekend [obviously]	soeplepel [soup-ladle]	toernooi [tournament]	vliegveld [airport]