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Phonological awareness in kindergarten: a field study in Luxembourgish schools

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Abstract The purpose of the present study was to assess the effectiveness of a phonological awareness training program in the specific context of the Luxembourgish educational system. The intervention was run by the kindergarten teachers in their classes with minimal external supervision. Forty-one classes of the area around Luxembourg City participated in the study. One hundred and fifty children from 20 kindergarten classes were part of the training group and 157 children from 21 classes formed the control group. At the end of kindergarten, clear training effects were observed for all phonological awareness tasks, except for the highly demanding phoneme deletion task. After 6 months of reading and writing instruction in first grade, no training effects were found in a pseudoword spelling task for the entire training group. Only at-risk children, which had the lowest performance on preschool phonological awareness measures, showed significant training effects. We conclude that early phonological awareness training may be profitably incorporated in kindergarten classroom activities, particularly for at-risk pupils, even when the language characteristics and teaching methods already concur in facilitating the understanding of the alphabetic principle.

Résumé L'objectif de la présente étude était d'évaluer l'effet d'un entraînement de la conscience phonologique dans le contexte particulier du système scolaire luxembourgeois. L'intervention a été menée par les enseignants préscolaires, dans leurs classes, et avec une supervision externe minimale. Quarante et une classes situées dans les communes adjacentes à la ville de Luxembourg ont participé. Cent cinquante enfants (20 classes) formaient le groupe d'entraînement et 157 enfants (21 classes) le groupe contrôle. A la fin de l'année des effets d'entraînements clairs ont été

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observés pour toutes les tâches de conscience phonologique sauf la plus difficile, la suppression de phonèmes. Après six mois d'apprentissage du langage écrit en première année d'étude, la tâche d'écriture de pseudo-mots sous dictée n'a pas permis de mettre en évidence un effet d'entraînement pour l'ensemble des enfants. Seuls les enfants à risque, qui avaient obtenu les moins bons résultats aux mesures de conscience phonologique en préscolaire, ont montré un effet d'entraînement significatif. Nous concluons qu'un entraînement précoce de la conscience phonologique peut être introduit avec profit dans les activités de l'école maternelle, particulièrement pour les enfants à risque, même lorsque les caractéristiques de la langue et des méthodes d'enseignement facilitent la compréhension du principe alphabétique.

Keywords Reading acquisition · Phonological awareness · Intervention study · At-risk children · German

According to Castles and Coltheart (2004), phonological awareness can be defined as referring "to the ability to perceive and manipulate the sounds of spoken words." It includes awareness of phonemes as well as awareness of larger units such as rimes and syllables. A large number of experimental studies have shown that training phonological awareness accelerates its development as well as the acquisition of reading and writing (for reviews, see, e.g., Bus and van Ijzendoorn 1999; Castles and Coltheart 2004; Ehri et al. 2001). Phonological training programs appear to have a positive influence on reading and writing acquisition even if they precede formal reading and writing instruction and without letter support (e.g., Lundberg et al. 1988; Schneider et al. 1997; for a review, see National Institute of Child Health and Human Development 2000). These results encourage the inclusion of phonological awareness activities within the educational context. The major purpose of the present work was to examine whether the conclusions of experimental studies would hold in a kindergarten classroom field setting. A second aim was to assess the influence of the phonological awareness training on children who are at risk of encountering learning difficulties with reading and spelling.

Although an impressive number of intervention studies have been published since the leading work of Bradley and Bryant (1983), recent reviews have insisted on the lack of field-based assessments. For instance, Troia (1999) commented that, of the seven studies that he retained as methodologically sound, "none evaluated the effects of classroom-based intervention," and concluded that "we do not have adequate evidence that phonological awareness treatment programs are ecologically valid and effective in classroom environments. It is possible that such programs may be impractical or too complex for implementation in the classroom and that the positive effects observed by researchers would be compromised in classroom practice" (p. 49). Fuchs et al. (2001) ran a systematic search of the literature and found only 13 among 41 intervention studies in which the program was administered by the teachers themselves in preschool or kindergarten classes. Obviously, there is a gap between experimental studies aimed at showing the causal nature of the relation between phonemic awareness and reading acquisition, and applied research intending to evaluate the educational effects of classroom activities, in a school setting where a number of additional factors might influence the unwinding and outcome of the endeavor.

The present study was organized in the multilingual school context of Luxembourg. Both for historical and geographical reasons, Luxembourg is a country with a complex linguistic situation. Multilingualism has been legally defined since 1984, when the status of national language was awarded to Luxembourgish. The language situation in Luxembourg is frequently referred to as "triglossic" (Horner and Weber 2008). French and German are official administrative languages, and primarily used in writing, whereas Luxembourgish is dominantly used for spoken

communication. Besides the three official languages, many other languages (e.g., Portuguese or English) are encountered in everyday life, due to the high percentage of immigrant population. To illustrate the complexity of everyday communication, among Portuguese students born in Luxembourg, 67% declare using Luxembourgish as the main language to communicate with classmates, 24% use predominantly French, 8% prefer Portuguese, and 2% use German (Fehlen 2009).

Luxembourgish belongs to the group of West Germanic languages. Luxembourgish is a mixed Romano-Germanic language. Native German speakers do not readily understand Luxembourgish (Katzner 2002). In terms of German dialectology, Luxembourgish is categorized under middle German dialects (Mitteldeutsch; see Berg and Weis 2005; Horner and Weber 2008). The use of multiple diphthongs is the main difference to German and French. Four consonants, seven vowels, and five diphthongs are included in the Luxembourgish phoneme system but not in the German one (Gaal 2008; Gilles 2006; Schanen 2004).

According to Horner and Weber (2008), the educational system acknowledges the significance of Luxembourgish as national language and emphasizes the influence of multilingualism. The use of Luxembourgish is a major objective of preschool instruction and Luxembourgish is the main language used by teachers. At first grade, German is the language of literacy and children acquire reading and writing skills in German (Kühn 2008). Oral French lessons start during the second grade, and written French classes are introduced at the beginning of grade 3. It is worth noting that teaching methods for both languages are different. The instruction of German is dominated by a method based on phonics, whereas French is taught with a global communicative approach. Letters are only introduced at first grade, and children from 4 to 6 years attend the same kindergarten classes. In primary school, official Luxembourgish language instruction plays only a very minor role. Only 1 h per week is devoted to formal Luxembourgish language instruction. Luxembourgish text reading is introduced at third grade, and Luxembourgish writing rules are only introduced after fifth grade (see Berg and Weis 2005; Horner and Weber 2008). However, informal everyday language use in and out of school is more complex, and numerous examples of code switching could be described. Teachers may switch to Luxembourgish when explaining difficult points to their students (Davis 1994); students would negotiate text writing in the language of instruction by using one or even several other languages (Weber 2009).

In the present research, more specifically, we identified five characteristics of the educational context that might modulate the effect of an early intervention: (a) the language use in the population, (b) the degree of transparency of the writing system, (c) the teaching method used for the acquisition of reading and writing skills, (d) the organization of kindergarten classes and activities, and (e) the nature and amount of teacher supervision during the intervention.

(a) The first aspect concerns the language environment of the kindergarten and primary school. Although most children learn to read and write in their first language, this is not always the case. Immigrant children often have to learn to read and write in a second language, and reading and writing instruction occurs in a second language in some countries. According to some authors, early bilingualism may have some effect on different phoneme awareness tasks (e.g., Bialystok 2007; Bialystok et al. 2003; Bruck and Genesee 1995). According to the meta-analyses of Genesee and Geva (2006), consistent evidence exists for the correlation between the level of phonological awareness reached in the first and the second language. Interestingly, both the phonological awareness level reached in the first language as well as the phonological awareness level reached in the second

language contribute to reading and writing acquisition in that second language (i.e., Chiappe and Siegel 1999). Phonological awareness training programs organized in a second language also seem to have a positive impact on reading and writing acquisition in that second language (Stuart 1999; Weber et al. 2007).

(b) A second factor that might modulate the effect of phonological awareness training is the degree of transparency of the relations between speech and writing. The transparency of the orthographic writing system is known to have an influence on the acquisition of reading and writing. In transparent orthographic systems (e.g., Spanish, Italian, Serbo-Croatian, or German, among others), much more than in opaque orthographic systems (e.g., French or English), reading and writing instruction accelerates the development of phonemic awareness as well as the correct use of the alphabetic principle (Goswami et al. 2005; Patel et al. 2004; Spencer and Hanley 2004; Wimmer and Goswami 1994; Wimmer et al. 1999). Few months of reading and writing instruction suffice to develop phoneme analysis skills in a transparent writing system (Wesseling and Reitsma 1998; Wimmer, Landerl, Linortner, Hummer 1991a) as well as to understand and apply the alphabetic principle (Blaser et al. 2007; Cossu 1999; Oney and Durgunoglu 1997; Wimmer et al. 1990). Thanks to the influence of reading and writing instruction, phonological awareness skills spontaneously developed at kindergarten age (e.g., syllables and rime awareness) usually allow a head start into reading and writing at first grade (Hanley et al. 2004; Mann and Wimmer 2002; Wimmer et al. 1991a).

(c) The teaching method also has an influence on the development of phoneme awareness. Whole language and phonic approaches are often contrasted. Whole language methods are predominantly based on the rote learning of whole words, whereas phonic methods are based on the explicit teaching of correspondences between phonemes and graphemes at an early stage. Compared to programs providing unsystematic or no phonic instruction, systematic phonic instruction accelerates reading acquisition and favors the development of phonemic awareness (e.g., Alegria et al. 1982; Bruck et al. 1998; Einsiedler et al. 2002; for a review, see National Institute of Child Health and Human Development 2000).

Considering together the facilitation provided by the transparency of the writing system and the use of a phonic teaching method, the question arises whether phoneme awareness training without letter support remains useful and effective at kindergarten age. Several kindergarten training studies (Lundberg et al. 1988; Reitsma and Wesseling 1998; Schneider et al. 1997) have shown positive training effects on reading or writing acquisition in transparent orthographic systems. Other training studies, however, showed reduced or no training effects at all (Blaser et al. 2007; Schneider et al. 1997).

(d) The effectiveness of phonological awareness training may also be influenced by various organizational factors. First, it is important to know which place language games occupy in kindergarten activities. For instance, rime and syllable awareness are tightly linked to daily kindergarten activities such as learning poems and songs (Jansen et al. 1999). Second, the introduction of letter forms, names, and sounds may facilitate the acquisition of phoneme awareness already in kindergarten (Ehri et al. 2001). Phonemic awareness requires explicit teaching of the phonic structure of the spoken language. Even if this explicit teaching can be ensured by using various games and activities without letter support (e.g., Lundberg et al. 1988; Schneider et al. 1997), including letters facilitates and accelerates the development of phonemic awareness (e.g., Schneider et al. 2000).

Other organizational factors that might affect phonological awareness training in kindergarten involve children's age (Rothe et al. 2004) and the number of children in the classroom (Peter 2006). The age at which children enter kindergarten and the age at which they first get formal reading instruction differ from one country to another. Younger

children can easily develop rime and syllable awareness in concrete and playful situations, but the development of phonemic awareness requires a higher level of analytical skills (Jansen et al. 1999) and seems to be more appropriate for older kindergarten children. In some countries such as Germany (Schneider et al. 1994), the Netherlands (Reitsma and Wesseling 1998), or Luxembourg, children of different ages (e.g., from four to six) are grouped together in the same classes. In other countries like Denmark, the age span of a kindergarten class is smaller (Lundberg et al. 1988). The total number of children in the classroom and the possibility to work with small groups is another important organizational aspect (Peter 2006). Phonological awareness training seems to be most effective when working systematically (Kjeldsen et al. 2003) and with small groups (Ehri et al. 2001).

(e) Finally, field studies require special steps to guarantee trainers' understanding of the intervention and their effective collaboration. According to Yeh (2003), there is a persistent belief among many educators that instruction in rhyming and alliteration are appropriate and sufficient to develop phonemic awareness and are more appropriate than segmentation and blending activities.

In the well-known and highly successful study by Lundberg et al. (1988), teachers attended an introductory course to be familiarized with the theoretical background of the project and the exercises of the training program. Schneider's field work in Germany demonstrated the critical importance of trainers' regular supervision. One of their studies (Schneider et al. 1997) included weekly supervision sessions of the kindergarten teachers. In that intervention, positive training effects were found on reading and writing for the whole training group, in first and second grade, whereas previous trials with the same instructional program but less systematic supervision produced weaker results.

In a large-scale real-life intervention program, it is not always possible to ensure intensive teacher supervision as well as the opportunity to work with small groups. Most of the time, when new curricula are introduced, teachers will have to work with their whole class; they will refer to published instructions and will get little or no direct supervision. Thus, to ensure practical validity, it may be more appropriate to provide only minimal direct supervision to the teachers involved in the training study.

The aim of the present study was to evaluate whether the conclusions of experimental phonological awareness training studies would also hold in a natural classroom setting in which various sub-optimal factors might come into play. In Luxembourg, children enter kindergarten at the age of four and remain at that level until the age of six. A single teacher takes care of a class of 18 children on average. The main language used in kindergarten is Luxembourgish. In first grade, reading and writing skills are taught in German, a highly transparent orthographic system, and the official teaching method is based on a systematic phonic approach.

A second aim was related to individual differences in the extent of the effect of training. The response of learners to any instruction program varies extensively. A longstanding issue in educational research is that in general a noteworthy proportion of the participants would not show effects of training, and, more importantly, that the number of "non-responders" is often larger in the lower ranges of the distribution, thus increasing rather than diminishing heterogeneity. For instance, Torgesen (2000) estimated that more than 20% of children at risk for reading difficulties fail to respond to early interventions. The ratio of non-responders may be even worse among children with learning disabilities (Torgesen and Davis 1996; Torgesen et al. 2001). Thus, in devising educational interventions, it is essential to assess whether the program is efficient for the children who are the most likely to need it, that is, those with low initial phonological awareness who are also at risk of developing reading and writing difficulties later on. In some studies (e.g., Torgesen and Davis

1996), at-risk children did not benefit as much from a phonological training program as the rest of the sample. Other researchers however (e.g., Lundberg 1994; Schneider et al. 1999) have reported positive effects on phonological awareness development and on reading and writing for children with low initial phonological awareness performance. It thus appeared essential to assess whether at-risk children would show favorable training effects to the same extent as the rest of the sample.

Method

Participants

Classes were chosen randomly from areas of comparable socioeconomic levels in the periphery to Luxembourg City. Only one of the contacted teachers preferred not to participate. The training group included 150 children from 20 kindergarten classes and the control group 157 children from 21 classes. Parents were asked to sign a consent form. Of the initial sample, 120 children from the training group and 135 from the control group remained in the same schools and participated in the final spelling test.

At the beginning of the study, mean age was 5 years 7 months (control group: 5 years 8 months; training group 5 years 7 months). The entire cohort included 168 boys (55%) and 139 girls (45%), with similar proportions in both groups. To obtain information about the children's first language, teachers were asked to indicate the language children predominantly used with each parent. One hundred and four of the 157 control children (66%) and 90 of the 150 training children (60%) spoke Luxembourgish with both parents. The proportion of children using another language than Luxembourgish with at least one of their parents most of the time (37%) closely approximates the proportion of migrant families in demographic statistics for the country. As phonological awareness training programs organized in a second language have a positive impact on reading and writing acquisition in that second language (Stuart 1999; Weber et al. 2007), children whose dominant language was not Luxembourgish were included when studying general training effects for the whole kindergarten group. However, when studying training effects on *specific* reading and writing difficulties (not linked to German oral language development), only the data from children speaking Luxembourgish with both parents were analyzed.

General procedure

In kindergarten, the study included three periods: pretest, training program, and posttest. At the beginning of the last year of kindergarten (in 1999), children received a series of tests to assess non-verbal intelligence, verbal short-term memory, active vocabulary, and pretest phonological awareness. Thereafter, training group teachers started the phonological training program, which included daily 10-min sessions of metalinguistic exercises and games throughout 20 weeks. The control group followed the regular kindergarten program. At the posttest, the same phonological awareness tasks were administered again, together with tests of letter identification, verbal short-term memory as well as active vocabulary. All kindergarten tests were run in Luxembourgish. In first grade, children's mastery of the alphabetic principle was assessed through a pseudoword spelling test (in German) after 6 months of reading and writing instruction.

Training program

The phonological training program developed by Lundberg and colleagues (Jager-Adams et al. 1997; Lundberg et al. 1988) and adapted to German by Schneider and colleagues (see Küspert and Schneider 2000; Schneider et al. 1997) was adapted to Luxembourgish (Bodé et al. 2004). The program included six metalinguistic training units of increasing difficulty: listening skills, rhyme recognition, and rhyme production, play with spoken sentences and words, syllable synthesis and syllable analysis, phoneme identification and deletion, and synthesis and phoneme analysis skills. These training units were introduced successively to the children.

Prior to the study, a 1-h information session was organized to introduce the teachers of the training group to the theoretical background of the study (aims of phonological training and links to the acquisition of reading and writing skills) and to the structure of the program. Teachers received a booklet describing the whole training program. Each task was presented with detailed instructions as well as examples.

The teachers of the training group were given the option to participate in monthly organized supervision sessions (2 h) tutored by the first author. The purpose of these sessions was to encourage teachers to use the training program regularly and to provide (practical) solutions for organizational difficulties. Seven out of 20 teachers of the training classes attended the sessions.

At the end of the training period, the teachers were asked to fill in a questionnaire on the application of the training program. They had to indicate which training unit they reached within the program, whether they introduced phoneme awareness exercises and of which kind.

Kindergarten tests

Kindergarten tests were chosen to assess non-verbal intelligence, verbal short-term memory, active vocabulary, and phonological awareness. Apart from the non-verbal intelligence test, which was presented at the pretest (colored progressive matrices test, Schmidtke et al. 1980), and the letter identification tasks, which was presented at the posttest, tests were administered twice, both at the pre- and the posttest.

Kindergarten testing was run in Luxembourgish. All the testing was carried out individually by well-trained second year students from the Luxembourgish Center for Teacher Training and Educational Research who were blind to pupils' group membership. On average, the pre- and posttest sessions lasted about 45 min. Most tests included items of increasing difficulty and were stopped after several consecutive errors.

The phonological awareness tasks were constructed along two main dimensions, the type of process involved to complete the task and the nature of the linguistic units upon which the task was based. Concerning type of process, we distinguished between analysis and synthesis tasks. These two processes seem to be logically connected, but they have been shown to represent distinct components of phonological awareness (Schatschneider et al. 1999; Wagner et al. 1993). Regarding the linguistic unit criterion, we contrasted three components of phonological awareness: rime, syllable, and phoneme awareness, following previous research (e.g., Hoien et al. 1995; Lundberg et al. 1988). Further, a progression from large to smaller linguistic units was enforced (Schaefer et al. 2009).

Analysis tasks included an oddity task and a deletion task. The rime oddity task included nine trials. Each trial consisted of four familiar monosyllabic words with the same vowel (e.g., ***Zuch*** [train], ***Kuch*** [cake], *Bus*, [bus], ***Duch*** [towel]). They were presented orally and visually

by pointing at corresponding pictures at the same time. The child had to identify the word which does not rhyme (***Bus***) with the three others.

The deletion task included 12 trials in total and included three subsets: final word deletion with compound words (e.g., *Sonne**blumm*** without ***Blumm*** gets *Sonne*, *sunflower* without *flower* gets *sun*), final syllable deletion with bisyllabic words, and final phoneme deletion with monosyllabic words.

For the synthesis tasks, modeled after Content et al. (1986), a hand puppet was used for presentation. The puppet was said to "talk badly" and the child was asked to help the puppet speak. The puppet, manipulated by the experimenter, pronounced linguistic units (syllables or phonemes) of the test items in isolation, at the rhythm of one per second (*D-U-CH*), and children were asked to pronounce the whole item by blending together the successive units (*Duch,* [towel]). The syllable synthesis task included six items (three bisyllabic items, two trisyllabic items, one four-syllabic item). The phoneme synthesis task included 20 monosyllabic CVC items. Half were words and half were pseudowords, created by changing the first phoneme of words. For 16 out of the 20 items, the final consonant had to be joined with the rest of the syllable (CV-C). For the remaining four items, the three phonemes were uttered separately (C-V-C) and had to be blended together.

In addition, children passed vocabulary, verbal short-term memory, and letter knowledge tests. The vocabulary test was adapted in Luxembourgish from the German active vocabulary test (Kiese and Kozielski 1996). Fourteen pictures out of the original 82 pictures were chosen for a picture-naming task. The verbal short-term memory test was a modified version of the digit span task using only digits from 1 to 7. The letter identification task included five consonants (M, S, N, T, G) and five vowels (I, U, E, O, A) which were written in black ink (1 cm) on a white page. Children were asked to name each letter.

First grade test

The understanding of the alphabetic principle, i.e., the understanding that phonemes correspond to letters, and vice versa, represents an essential step in reading and spelling acquisition (Byrne 1998). Most developmental theories attribute a critical role to the emergence of an alphabetic strategy, allowing children to read and write new or unfamiliar words, thanks to their knowledge of grapheme–phoneme correspondences (see Content and Zesiger 1999 for an overview). Similarly, Share's self-learning hypothesis (Share 1995, 1999) assumes that the mastery of the alphabetic principle constitutes the essential foundation upon which the learner can build efficient reading and writing routines.

When learning to read and write in a transparent orthographic system, a few months of formal instruction suffice to understand and apply the alphabetic principle. In such writing systems, children already reach a high level of performance before the end of grade 1 (Cossu 1999; Oney and Durgunoglu 1997; Wimmer et al. 1990). Furthermore, children encountering reading and writing difficulties in first grade make more mistakes when writing pseudowords (Wimmer and Hummer 1990), and early differences between good and poor spellers tend to get smaller with ongoing reading and writing instruction (Signorini 1997; Wimmer et al. 1991b). As a strong link exists between phonological awareness and spelling, even in more transparent orthographic systems (Babayiğit and Stainthorp 2007; Landerl and Wimmer 2008), we thought that it is appropriate to evaluate children's mastery of the alphabetic principle before the end of grade 1. We used a pseudoword spelling task, which can be considered a relatively pure measure of phoneme–grapheme conversion, while also allowing for classroom testing, which was deemed important to avoid any risk of experimenter-induced effects. According to the official

school program, children should be familiar with ten graphemes (S, I, M, A, T, L, E, N, K, EI) at this time. These graphemes were used to construct eight pseudowords (*Kelat*, *Anita*, *Kima*, *Tilam*, *Setein*, *Linat*, *Mentil*, *Mita*) including a total of 39 graphemes. The teachers dictated the pseudowords to the children as if they were animal names. Each pseudoword was embedded in a short descriptive sentence (in German) and illustrated by a picture. Every grapheme spelling that did not respect the correct pronunciation was coded as an error.

Results

Overall training effects

The first aim of the present study, focusing on the whole sample, was to look at the effects of phonological awareness training on phonological skills in kindergarten and the application of the alphabetical principle in first grade.

Kindergarten data

Teachers' responses on the training progress forms showed that the exercises included in the beginning of the program such as rime and syllable awareness as well as phoneme synthesis had been applied in all classes. However, phoneme segmentation tasks, which appeared near the end of the program, had not been applied in all classes. One main reason given by kindergarten teachers to explain the omission of phoneme segmentation tasks was a slower rhythm of progression caused by other time constraints or activity priorities. Such timing difficulties are also encountered in other training contexts. Moreover, kindergarten teachers tended to feel less familiar with the highly structured phoneme analysis exercises and encountered more difficulties when introducing these in the classrooms (see also Yeh 2003).

Internal consistency reliability was computed for all pre- and posttest tasks, using Cronbach's alpha test. Cronbach's alpha is mathematically equivalent to the average of all possible split-half estimates. All values for the phonological awareness test items were above 0.60 indicating fair internal consistency for each task. Therefore, children's performance on all test items was taken into account in the following statistical analyses. For each phonological task, a total score was calculated at the pre- and posttest.

Table 1 gives an overview of pre- and posttest average results. The pretest phonological awareness scores of the training and control group were compared with one-way analysis of variance. Although the control group outperformed the experimental group on all tests, the difference never reached statistical significance, excepted for the syllable deletion task, $F(1, 306)=6.45$, $p<0.05$.

To evaluate the effect of the training program, we ran two (group) by two (measurement point) repeated measures analyses of variance. The analyses yielded significant group × measurement point interaction (training effects) for nearly all of the phonological awareness measures (rime oddity, $F(1, 305)=6.99$, $p<0.01$; syllable synthesis, $F(1, 305)=10.07$, $p<0.005$; phoneme synthesis into words, $F(1, 305)=26.71$, $p<0.001$; phoneme synthesis into pseudowords, $F(1, 305)=29.01$, $p<0.001$; syllable deletion $F(1, 305)=11.39$, $p<0.001$).

No significant effects were found for the word deletion task ($F<1$) and the phoneme deletion task ($F(1, 305)=1.28$, $p>0.1$), for which both groups obtained extremely low scores (below 20% correct) even at the posttest. In contrast to phonological awareness tasks, no

Table 1 Mean number of correct responses and standard deviations for all kindergarten tests as a function of measurement point (pretest vs. posttest) and group (training vs. control)

Task	Training group (n=150)		Control group (n=157)	
	Pretest	Posttest	Pretest	Posttest
Rime oddity (max.=9)				
M	3.22	5.51	3.30	4.69
SD	2.51	2.94	2.73	2.61
Syllable synthesis (max.=6)				
M	4.56	5.65	4.86	5.41
SD	1.73	0.95	1.33	1.06
Phoneme synthesis words (max.=10)				
M	5.05	8.32	5.23	6.69
SD	3.15	2.26	3.08	2.40
Phoneme synthesis pseudowords (max.=10)				
M	2.71	6.28	2.89	4.36
SD	2.85	3.47	2.94	3.20
Word deletion (max.=4)				
M	1.60	2.72	1.75	2.71
SD	1.43	1.28	1.41	1.27
Syllable deletion (max.=4)				
M	0.77	2.15	1.13	1.85
SD	1.13	1.45	1.34	1.36
Phoneme deletion (max.=4)				
M	0.63	1.29	0.78	1.20
SD	1.31	1.50	1.35	1.57
Raven matrices (max.=36)				
M	15.89	[a]	16.05	[a]
SD	5.62		4.90	
Verbal memory span (max.=9)				
M	2.70	3.39	2.87	3.61
SD	1.56	1.56	1.66	1.55
Active vocabulary (max.=17)				
M	9.79	10.71	10.14	11.34
SD	4.71	3.85	4.17	3.61
Letter naming (max.=10)				
	n=73	n=150	n=122	n=157
M	1.84	4.16	1.71	4.34
SD	2.26	3.10	2.60	3.31

Not all children passed the letter naming pretest

[a] Raven matrices were only passed at pretest

training effects were found for the active vocabulary test ($F(1, 305)=1.95$, $p>0.1$), verbal memory span, and letter identification (both Fs<1).

Effect size (d_{ppc}) based on the pooled pre- and posttest standard deviation (Morris 2008) was used to estimate the impact of training on phonological awareness tasks passed at pre-

and posttest. The largest d_{ppc} values were found for the phoneme synthesis into words task (d_{ppc}=0.66) and for the phoneme synthesis into pseudowords task (d_{ppc}=0.67). Medium to small effects were found for the syllable deletion task (d_{ppc}=0.5), the syllable synthesis task (d_{ppc}=0.41), and the rime oddity task (d_{ppc}=0.433).

First grade data

Spelling performance was assessed by counting the errors, over a total of 39 graphemes. After 6 months of reading and writing instruction, spelling performance was already surprisingly high as the percentage of errors was below 10%. The control group produced slightly fewer errors (*M* of errors=2.61, SD=5.57) than the training group (*M* of errors=3.13, SD=6.01). It should be noted that about 15% of the children of the total kindergarten sample (53 out of 307) did not participate in the pseudoword spelling test at first grade. The dropout group included 22 children of the control group and 31 children of the training group. One-way analyses of variance showed that the training dropout group and the control dropout group did not differ significantly for any of the tests. Moving away from participating schools, absences at the test moment or retarded first grade admission (1.9% on average country wide; Unsen 2008) are possible explanations for these dropouts. As dropouts included all the children with retarded first grade admission, the following results cannot be extended to this sub-group of children. In the remaining sample of children tested at first grade, the control group obtained marginally better scores on the pretest tasks than the training group. Hence, we ran hierarchical stepwise regression analyses in order to control for pretest performance.

All pretest scores except letter naming (i.e., non-verbal intelligence, active vocabulary, verbal short-term memory, rime oddity, syllable synthesis, phoneme synthesis into words and pseudowords, word deletion, syllable deletion, phoneme deletion) were entered in a first step, and the contribution of a dummy variable coding for intervention (training group=1, control group=0) was entered in a second step. The only predictors to contribute significantly to pseudoword spelling performance were syllable synthesis into words ($p<0.001$, r^2 change= 0.15) and verbal short-term memory ($p<0.001$, r^2 change=0.05). The training program added no significant contribution to the explained variance.

Training effects for at-risk children

The second aim of the present study was to assess the effect of phonological awareness training on preschool children with low phonological awareness development at kindergarten and at risk of encountering specific reading and writing problems subsequently. Therefore, we identified a subset of children with low phonological awareness scores at the beginning of the program. Only the children speaking predominantly Luxembourgish with both parents and for which all kindergarten and first grade data (n=164) were available were included in the following analyses. Indeed, for non-native speakers, it was impossible to evaluate whether low performance on phonological awareness tasks was due to the limited mastery of the Luxembourgish language or specific to phonological awareness development.

To obtain a composite phonological awareness score at the pretest time, we calculated the sum of z-score transforms of all the phonological awareness tasks. The children who obtained scores falling in the lowest quartile were categorized as “at-risk.” At-risk children were equally distributed between the training (n=20) and the control group (n=21). The children from the training group came from 12 different classes and those of the control group came from 13 classes.

To provide an overview of the characteristics of the at-risk group also tested at first grade, pretest results were compared to those of the children from the three other quartiles. As shown in Table 2, the at-risk group not only obtained lower scores for the phonological awareness tasks, but showed weaker performance also for non-verbal intelligence, verbal short-term memory, and active vocabulary. One-way analyses of variance showed that these differences were all statistically significant ($p<0.05$).

Table 2 presents the pretest and posttest results for at-risk children. One-way ANOVAs showed no significant differences at the pretest between control and training at-risk groups.

A significant training effect, indexed by the group × measurement point interaction, was only found for phoneme synthesis into pseudowords ($F(1, 39)=4.77$, $p<0.05$), an effect of large size ($d_{ppc}=0.90$), which would however not hold if the alpha level was adjusted for multiple comparisons (Bonferroni correction). A similar trend was present, though not significant, for phoneme synthesis into words, ($F(1, 39)=1.91$, $p>0.1$). All other tasks showed no significant evolution from pre- to posttest (all Fs~1).

Finally, we examined the first grade pseudoword spelling errors for the at-risk groups as a function of training. Descriptively, the experimental group produced clearly fewer errors (M errors=2.35, SD=2.91) than the control group (M errors=5.71, SD=6.67), in which the variability was also much larger. A hierarchical regression analysis showed that none of the pretest variables contributed significantly to pseudoword spelling, whereas the group factor was significant ($p<0.05$) and accounted for 10% of the variance (r^2 change=0.10).

It is also noteworthy that the average score of the at-risk training group was comparable to that of the children from the three other quartiles, with training ($n=52$, $M=2.50$, SD=4.01) or without ($n=71$, $M=1.39$, SD=3.65). A one-way ANOVA comparing the four groups (at-risk and other, experimental, and control groups) confirmed the presence of a significant difference ($F(1, 163)=4.83$, $p<0.005$). More interestingly, contrasts showed that the at-risk control group made significantly more errors ($p=0.05$) than the other three sub-groups, which did not significantly differ from each other.

Finally, there are also differences in inter-individual variability. The standard deviation observed for the at-risk control group (SD=6.67) is much higher than the standard deviation observed for the at-risk training group (SD=2.91). This difference is significant, according to Levene's test for equality of variances ($p<0.005$). Overall, 10% of the children made more than six errors, 25% produced more than three errors and 50% more than one. Figure 1 shows the distribution of error scores for at-risk children. Eight of them made more than six errors (percentile 10), one from the training group and seven from the control group. Those children came from seven different first grade classes. In sum, the detailed examination of individual scores confirmed that children with low phonological awareness scores at kindergarten incur higher risk of failure in a spelling test, and that phonological awareness training during kindergarten may help these children to avoid learning failure.

Discussion

Many facets of the educational system and traits of the schools, classroom context, as well as teachers may modulate the efficacy of large-scale phonological training programs. One purpose of the present study was to examine the effectiveness of phonological awareness training in a real school situation in which various sociolinguistic, personal, and organizational factors would come into play. To recall, the major characteristics of the Luxembourgish situation are the following: reading and writing are taught in German in first grade rather than in Luxembourgish, the main language spoken in the country; a large

Table 2 Mean number of correct responses and standard deviations (in parentheses) for the at-risk children of the training and the control groups for all kindergarten measures as a function of measurement point (pretest vs. posttest)

Task	Training group (n=20)		Control group (n=21)	
	Pretest	Posttest	Pretest	Posttest
Rime oddity (max.=9)				
M	2.40	5.35	2.00	4.14
SD	2.19	2.43	1.87	2.41
Syllable synthesis (max.=6)				
M	4.05	5.20	4.42	5.24
SD	1.19	1.44	1.29	0.94
Phoneme synthesis words (max.=10)				
M	3.05	7.15	3.43	5.90
SD	2.60	2.52	2.73	2.79
Phoneme synthesis pseudowords (max.=10)				
M	0.55	4.60	0.90	2.95
SD	0.10	3.53	1.22	2.35
Word deletion (max.=4)				
M	0.75	2.40	0.95	2.43
SD	1.16	1.27	1.07	1.25
Syllable deletion (max.=4)				
M	0.20	1.50	0.19	1.90
SD	0.41	1.50	0.40	1.04
Phoneme deletion (max.=4)				
M	0.00	0.70	0.00	1.24
SD	0.00	1.08	0.00	1.73
Non-verbal intelligence (max.=36)				
M	15.40	[a]	13.90	[a]
SD	3.75		4.83	
Short-term memory (max.=9)				
M	2.15	2.95	1.90	3.29
SD	1.46	1.57	1.34	1.35
Active vocabulary (max.=17)				
M	11.55	11.75	10.67	12.14
SD	2.78	1.94	2.74	3.02

[a] Raven matrices were only passed at pretest

portion of the population (about 40% of the children in our sample) are of foreign origin, so that neither German nor Luxembourgish are their first language; German spelling is relatively transparent with regard to spelling–sound mappings; a systematic phonic approach is used for literacy instruction starting in first grade, and there is very little formal prereading instruction at kindergarten level; finally, children aged from four to six join together in the same classes.

Posttests administered immediately after the training showed that the program had positive effects on most phonological awareness tests. Statistical effects of medium size were found for

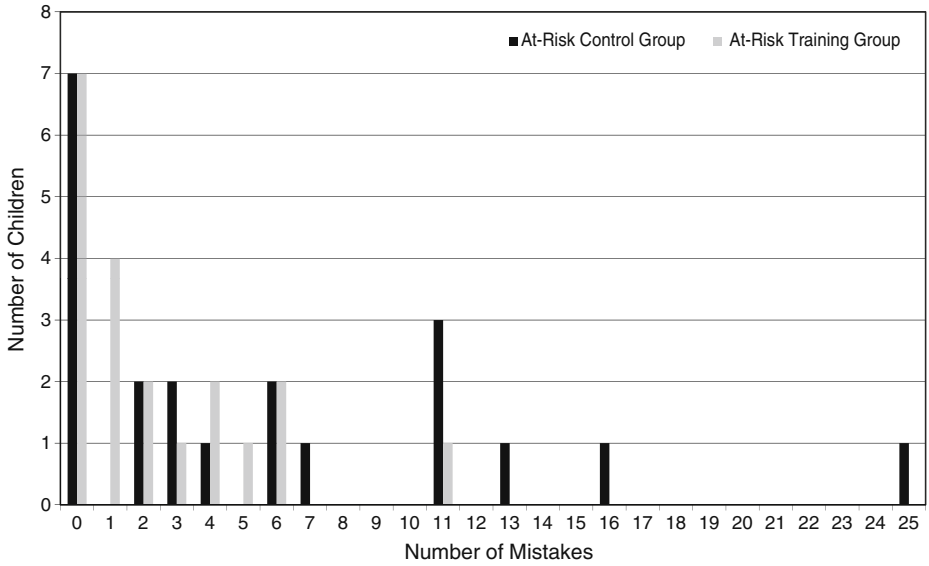

Fig. 1 Frequency distribution for the number of mistakes committed at the pseudoword spelling task

the phoneme synthesis into words and pseudowords tasks. Smaller effects were found for the rime oddity, syllable synthesis, and syllable deletion tasks. There was no training effect for the phoneme deletion task, which is known to require a very high level of analytical skills (Bentin 1992; Jansen et al. 1999; Stanovich 1992), and was only introduced at the very end of the program. Since only about half the teachers reported applying the program up to the last stages, the lack of effect for the phoneme deletion test is not surprising.

After 6 months of reading and writing acquisition in German, mastery of the alphabetic principle, as assessed by a simple pseudoword spelling task, was already quite good for most children. Indeed, on average, both the training and the control group made few errors on the pseudoword spelling task. Using hierarchical regression analyses, the only predictors contributing significantly to performance on the pseudoword spelling task were the syllable synthesis into words and verbal short-term memory tasks. Neither the use of the training program nor teachers' participation at supervision sessions did contribute significantly to the explained variance.

Even though the Luxembourgish situation presents some specificities, the results show large similarities with those of other intervention studies conducted in German. The reduced effect of the training program on phonemic awareness and written language acquisition was also described by Schneider et al. (1997).

As in the present study, Schneider et al. (1997) reported that 13 kindergarten teachers out of 22 did not apply the program consistently and perfectly until the very end. For those classes, the intervention program had reduced effects on phoneme awareness and did not generalize to written language acquisition. In a second study however, the same research group showed that more systematic supervision and more regular coaching of the teachers helped to solve organizational difficulties and led to larger phoneme awareness training effects, together with significant effects on written language learning at first grade.

Further results of the present study are coherent with the international findings underlining the positive impact of reading and writing instruction in transparent orthographic systems on phoneme awareness development. A high level of performance

for pseudoword spelling has also been reported by Wimmer et al. (1990), in Austria, after 8 months of reading and writing instruction. As in the Luxembourgish school system, Austrian schools use a phonic method. Thus, together with Wimmer's results, our findings provide additional support to the view that the combination of a phonic approach and a relatively transparent mapping of phonemes and graphemes allow most children to grasp the alphabetic principle rather rapidly.

Despite the facilitating influence of orthographic transparency and the use of a phonic method in early teaching, some children still encounter reading and writing difficulties (Porpodas 1999; Signorini 1997; Wimmer 1996; Wimmer and Hummer 1990; Wimmer et al. 1991b). Phonological awareness training during kindergarten might thus be of particular interest for these children. In the present study, at-risk Luxembourgish speaking children took advantage of the training program: they improved on the phoneme synthesis immediate posttest, and they showed significantly better pseudoword spelling performance in first grade, where the training accounted for about 10% of variance. This positive result is even more striking given the fact that the phonological awareness training was run in Luxembourgish, whereas reading and writing are taught in the German language.

These results are coherent with those found by Blaser et al. (2007). In this Swiss field study, a phonological awareness training program was applied in Swiss German dialect (Schweizerdeutsch) at kindergarten. No significant training effects were found at the end of the first or second grade for the entire kindergarten group, and the authors suggested that reduced teacher supervision as well as formal instruction in first grade might explain these negative training outcomes. However, at the end of first grade, the proportion of pupils from the training group (7.7%, 2 out of 26) scoring below the 25th percentile in spelling (computed within each class) was smaller than the corresponding proportion either within the training classmates group (who received no training at kindergarten but attended the same first grade classes than the training group, 19.1%, 29 out of 152) or within control classes (19.2%, 5 out of 26 and 19.7%, 30 out of 152, respectively, for the control group and control classmates group).

Thus, both for the present study and the Swiss study, secondary analyses highlight interesting positive trends regarding children encountering difficulties with spelling. It is interesting to note that these results were found in different school contexts (the Luxembourgish and the Swiss one) sharing some similarities: the languages of the training programs (Luxembourgish and Swiss German) belong to the group of Germanic languages, and children learn to read and write in a transparent writing system (German). Both studies are intervention studies exploring phonological awareness training effects in real-life settings: kindergarten teachers only received reduced supervision and the training groups included at-risk children together with normally developing children.

In sum, from an educational viewpoint, these results are encouraging. In general, at-risk children seem to benefit from phonological awareness activities, which can be integrated easily in the existing kindergarten context and do not require either special expertise or important supervision of the trainers. Moreover, from a prevention perspective, kindergarten activities might help teachers to detect non-responders, who may be the most exposed to learning difficulties. It would also be interesting to study training effects for children acquiring Luxembourgish as a second language and for children with retarded first grade curriculum. These studies are of special interest due to the fact that children of these sub-groups present a higher risk of encountering difficulties in reading and writing development (Bodé et al. 2009; Martin 2008; Portante

and Max 2008, Maurer-Hetto 2009) and also because the number of children faced with literacy acquisition in a second language is increasing considerably with the extension of migration in the western regions.

The findings of German intervention studies demonstrated that the establishment of a large-scale training program does not always warrant positive effects. In specific school contexts, a set of curricular (i.e., late introduction of letter learning), organizational (i.e., pooling of age groups in the same class), or sociolinguistic factors (i.e., difference between language used in kindergarten and language used for literacy instruction) may impede or discourage the introduction of phonological awareness activities in preschool and kindergarten classes. However, the present study showed that despite the specific constraints of the Luxembourgish system, and the lack of systematic supervision of the trainers, at-risk children benefited from the training.

More generally, our research shows that the adjustment of an experimental design to a field study requires a number of additional factors to be taken into account. We believe that field studies are essential not only to evaluate the effect of didactic and intervention tools, but also to help teachers, educators, and decision makers transpose the results of research into informed practice.

References

Alegria, J., Pignot, E., & Morais, J. (1982). Phonetic analysis of speech and memory codes in beginning readers. *Memory & Cognition, 10*, 451–556.

Babayiğit, S., & Stainthorp, R. (2007). Preliterate phonological awareness and early literacy skills in Turkish. *Journal of Research in Reading, 30*, 394–413.

Bentin, S. (1992). Phonological awareness, reading, and reading acquisition: A survey and appraisal of current knowledge. In R. Frost & L. Katz (Eds.), *Orthography, phonology, morphology and meaning* (pp. 193–210). Amsterdam: Elsevier.

Berg, Ch, & Weis, Ch. (2005). *Sociologie de l'enseignement des langues dans un environnement multilingue. Rapport national en vue de l'élaboration du profil des politiques linguistiques éducatives luxembourgeoises [Sociology of language education in a multilingual context]*. Luxembourg: Ministère de l'Education nationale et de la Formation professionnelle, Centre d'Etudes sur la Situation des Jeunes en Europe.

Bialystok, E. (2007). Acquisition of literacy in bilingual children: A framework for research. *Language Learning, 57*, 45–77.

Bialystok, E., Majumder, S., & Martin, M. (2003). Developing phonological awareness: Is there a bilingual advantage? *Applied Psycholinguistics, 24*, 27–44.

Blaser, R., Preuss, U., Groner, M., Groner, R., & Felder, W. (2007). Short-, middle and long-term effects of training in phonological awareness and letter-sound correspondence on phonological awareness and on reading and spelling. *Zeitschrift für Kinder- und Jugendpsychiatrie und Psychotherapie, 35*, 273–280.

Bodé, S., Beffort, A., Heinen, S., Jenn, P., Kinnen, M., Larosch, A., et al. (2004). *Phonologesch Bewosstheet am Spillschoulsalter [Phonological awareness at kindergarten age]*. Luxembourg: Université du Luxembourg.

Bodé, S., Serres, J., & Ugen, S. (2009). Similarities and differences of Luxembourgish and Romanophone 12 year old's spelling strategies in German and in French. *Written Language and Literacy, 12*, 82–96.

Bradley, L., & Bryant, P. E. (1983). Categorising sounds and learning to read: A causal connection. *Nature, 301*, 419–421.

Bruck, M., & Genesee, F. (1995). Phonological awareness in young second language learners. *Journal of Child Language, 22*, 307–324.

Bruck, M., Treiman, R., Caravolas, M., Genesee, F., & Cassar, M. (1998). Spelling skills of children in whole language and phonics classrooms. *Applied Psycholinguistics, 19*, 669–684.

Bus, A. G., & van Ijzendoorn, M. H. (1999). Phonological awareness and early reading: A meta-analysis of experimental training studies. *Journal of Educational Psychology, 91*, 403–414.

Byrne, B. (1998). *The foundation of literacy: The child's acquisition of the alphabetic principle*. Hove: Psychology Press.

Castles, A., & Coltheart, M. (2004). Is there a causal link from phonological awareness to success in learning to read? *Cognition, 91*, 77–111.

Chiappe, P., & Siegel, L. S. (1999). Phonological awareness and reading acquisition in English- and Punjabi-speaking Canadian children. *Journal of Educational Psychology, 91*, 20–28.

Content, A., & Zesiger, P. (1999). L'acquisition du langage écrit. [Written language acquisition]. In J. A. Rondal & X. Seron (Eds.), *Troubles du langage. Bases théoriques, diagnostic et rééducation [Language disorders: Theoretical foundations, diagnostic and reeducation]* (pp. 179–209). Sprimont: Mardaga.

Content, A., Kolinsky, R., Morais, J., & Bertelson, P. (1986). Phonetic segmentation in prereaders: Effect of corrective information. *Journal of Experimental Child Psychology, 42*, 49–72.

Cossu, G. (1999). The acquisition of Italian orthography. In M. Harris & G. Hatano (Eds.), *Learning to read and write: a cross-linguistic perspective* (pp. 10–33). New York: Cambridge University Press.

Davis, K. A. (1994). *Language planning in multilingual contexts: Policies, communities, and schools in Luxembourg*. Amsterdam: Benjamins.

Ehri, L. C., Nunes, S. R., Willows, D. M., Schuster, B. V., Yaghoub-Zadeh, Z., & Shanahan, T. (2001). Phonemic awareness instruction helps children learn to read: Evidence from the National Reading Panel's meta-analysis. *Reading Research Quarterly, 3*, 250–287.

Einsiedler, W., Frank, A., Kirschhock, E.-M., Martschinke, S., & Treinies, G. (2002). Effects of different teaching methods on phonological awareness and on literacy skills in first grade. *Psychologie in Erziehung und Unterricht, 49*, 194–209.

Fehlen, F. (2009). *BaleineBis: Une enquête sur un marché linguistique multilingue en profonde mutation - Luxemburgs Sprachenmarkt im Wandel [Luxembourgish language market in change]*. Luxembourg: SESOPI Centre Intercommunautaire.

Fuchs, D., Fuchs, L. S., Thompson, A., Otaiba, S. A., Yen, L., Yang, N. J., et al. (2001). Is reading important in reading-readiness programs? A randomized field trial with teachers as program implementers. *Journal of Educational Psychology, 93*(2), 251–267.

Gaal, S. (2008). *Automatic Phonetic Annotation - an HMM-based Phonetic Aligner for Luxembourgish. Preliminary diploma thesis supervised by Peter Gilles.* Retrieved December 18, 2009, from http://www.ims.uni-stuttgart.de-studienarbeit.pdf

Genesee, F., & Geva, E. (2006). Cross-linguistic relationships in working memory, phonological processes, and oral language. In D. August & T. Shanahan (Eds.), *Developing Literacy in second-language learners. Report of the national literacy panel on language-minority children and youth* (pp. 175–185). Mahwah: Lawrence Erlbaum Associates.

Gilles, P. (2006). *Einführung in die luxemburgische Linguistik I - Phonetik.* Retrieved November, 2006, from http://flshase.uni.lu/ur4el/images/stories/luxLing/einfuehrungphonetik-ws2006-07.pdf. Cited in Gaal, S. (2008). *Automatic Phonetic Annotation - an HMM-based Phonetic Aligner for Luxembourgish. Preliminary diploma thesis supervised by Peter Gilles.* Retrieved December 18, 2009, from http://www.ims.uni-stuttgart.de-studienarbeit.pdf

Goswami, U., Ziegler, J., & Richardson, U. (2005). The effects of spelling consistency on phonological awareness: A comparison of English and German. *Journal of Experimental Child Psychology, 92*, 345–365.

Hanley, R., Masterson, J., Spencer, L., & Evans, D. (2004). How long do the advantages of learning to read a transparent orthography last? An investigation of the reading skills and reading impairment of Welsh children at 10 years of age. *The Quarterly Journal of Experimental Psychology. A: Human Experimental Psychology, 57*, 1393–1410.

Hoien, T., Lundberg, I., Stanovich, K. E., & Bjaalid, I. K. (1995). Components of phonological awareness. *Reading and Writing, 7*, 171–188.

Horner, K., & Weber, J.-J. (2008). The language situation in Luxembourg. *Language Planning, 9*, 69–128.

Jager-Adams, M., Foorman, B. R., Lundberg, I., & Beeler, T. (1997). *Phonemic awareness in young children*. Maryland: Paul H. Brookes Publishing.

Jansen, H., Mannhaupt, G., Marx, H., & Skowronek, H. (1999). *Bielefelder Screening zur Früherkennung von Lese-Rechtschreibschwierigkeiten (BISC). [Bielefelder's Screening for the early diagnosis of reading and writing difficulties]*. Göttingen: Hogrefe.

Katzner, K. (2002). *The languages of the world*. Routledge.

Kiese, Ch, & Kozielski, P.-M. (1996). *Aktiver Wortschatztest für 3–6 jährige Kinder. [Active vocabulary test for 3–6-year-old children]*. Göttingen: Beltz-Test.

Kjeldsen, A., Niemi, P., & Oloffson, A. (2003). Training phonological awareness in kindergarten level children: Consistency is more important than quantity. *Learning and Instruction, 13*, 349–365.

Kühn, P. (2008). *Bildungsstandards Sprachen. Leitfaden für den kompetenzorientierten Sprachunterricht an Luxemburger Schulen. [Educational standards for languages. Guideline for competence oriented*

language classes in Luxembourgish schools]. Luxembourg: Ministère de l'Education nationale et de la Formation professionnelle.

Küspert, P., & Schneider, W. (2000). *Hören, Lauschen, Lernen. Sprachspiele für Vorschulkinder. Würzburger Trainingsprogramm zur Vorbereitung auf den Erwerb der Schriftsprache. [Hearing, listening, learning. Language games for preschoolers. Würzburger training program for the preparation of literacy acquisition.]*. Göttingen: VandenHoeck & Ruprecht.

Landerl, K., & Wimmer, H. (2008). Development of word reading fluency and orthographic spelling in a consistent orthography: An 8-year follow-up. *Journal of Educational Psychology, 100*, 150–161.

Lundberg, I. (1994). Reading difficulties can be predicted and prevented: a Scandinavian perspective on phonological awareness and reading. In C. Hulme & M. Snowling (Eds.), *Reading development and dyslexia* (pp. 180–199). London: Whurr.

Lundberg, I., Frost, J., & Petersen, O. P. (1988). Effects of an extensive program for stimulating phonological awareness in preschool children. *Reading Research Quarterly, 23*, 263–284.

Mann, V., & Wimmer, H. (2002). Phoneme awareness and pathways into literacy: a comparison of German and American children. *Reading and Writing, 15*, 653–682.

Martin, R. (2008). *La place de l'école dans la société luxembourgeoise de demain. Vers de nouveaux modèles de fonctionnement du système éducatif.* Bruxelles: DeBoek.

Maurer-Hetto, M.-P. (2009). Struggling with the language of the 'legitimate market' and the 'islets of liberty' (Bourdieu). A case study of pupils with immigrational background in the trilingual school-system of Luxembourg. *International Journal of Multilingualism, 6*, 68–84.

Morris, S. B. (2008). Estimating effect sizes from pretest–posttest-control group designs. *Organizational Research Methods, 11*, 364–386.

National Institute of Child Health and Human Development. (2000). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction: Reports of the subgroups*. Washington: Government Printing Office.

Oney, B., & Durgunoglu, A. Y. (1997). Beginning to read in Turkish: a phonologically transparent orthography. *Applied-Psycholinguistics, 18*, 1–15.

Patel, T. K., Snowling, M. J., & de Jong, P. F. (2004). A cross-linguistic comparison of children learning to read in English and Dutch. *Journal of Educational Psychology, 96*, 785–797.

Peter, A. (2006). Sprachförderung am Beispiel des,Würzburger Trainingsprogramm zur Vorbereitung auf den Erwerb der Schriftsprache' [Language education with the, Würzburger training program preparing written language acquisition,]. Grin Verlag.

Porpodas, C. D. (1999). Patterns of phonological and memory processing in beginning readers and spellers of Greek. *Journal of Learning Disabilities, 32*, 406–416.

Portante, D., & Max, C. (2008). Plurilingualism and plurilingual literacy among young learners in Luxembourg. In C. Kenner & T. Hickey (Eds.), *Multilingual Europe: diversity and learning* (pp. 124–130). Stoke-on-Trent: Trentham Books.

Reitsma, P., & Wesseling, R. (1998). Effects of computer-assisted training of blending skills in kindergartners. *Scientific Studies of Reading, 2*, 301–320.

Rothe, E., Grunling, C., Ligges, M., Fackelmann, J., & Blanz, B. (2004). First effects of training phonological awareness in two age cohorts of kindergarten children. *Zeitschrift für Kinder- und Jugendpsychiatrie und Psychotherapie, 32*, 167–176.

Schaefer, B., Fricke, S., Szczerbinski, M., Fox-Boyer, A., Stackhouse, J., & Wells, B. (2009). Development of a test battery for assessing phonological awareness in German-speaking children. *Clinical Linguistics & Phonetics, 23*, 404–430.

Schanen, F. (2004). *Parlons luxembourgeois. [Let's talk Luxembourgish]*. Paris: L'Harmattan.

Schatschneider, C., Francis, D. J., Foorman, B. R., Fletcher, J. M., & Mehta, P. (1999). The dimensionality of phonological awareness: An application of item response theory. *Journal of Educational Psychology, 91*, 439–449.

Schmidtke, A., Schaller, S., & Becker, P. (1980). *Raven-Matrizen-Test. [Coloured progressive matrices]*. Weinheim: BeltzTest.

Schneider, W., Ennemoser, M., Roth, E., & Küspert, P. (1999). Kindergarten prevention of dyslexia: does training in phonological awareness work for everybody? *Journal of Learning Disabilities, 32*, 429–436.

Schneider, W., Küspert, P., Roth, E., Visé, M., & Marx, H. (1997). Short- and long-term effects of training phonological awareness in kindergarten: Evidence from two German studies. *Journal of Experimental Child Psychology, 66*, 311–340.

Schneider, W., Roth, E., & Ennemoser, M. (2000). Training phonological skills and letter knowledge in children at risk for dyslexia: A comparison of three kindergarten intervention programs. *Journal of Educational Psychology, 92*, 284–295.

Schneider, W., Visé, M., Reimers, P., & Blässer, B. (1994). Auswirkungen eines Trainings der sprachlichen Bewußtheit auf den Schriftspracherwerb in der Schule. [Effects of a phonological awareness training on the acquisition of literacy.]. *Zeitschrift fuer Paedagogische Psychologie, 8*, 177–188.

Share, D. L. (1995). Phonological recoding and self-teaching: sine qua non of reading acquisition. *Cognition, 55*, 151–218.

Share, D. L. (1999). Phonological recoding and orthographic learning: A direct test of the self-teaching hypothesis. *Journal of Experimental Child Psychology, 72*, 95–129.

Signorini, A. (1997). Word reading in Spanish: A comparison between skilled and less skilled beginning readers. *Applied-Psycholinguistics, 18*, 319–344.

Spencer, L. H., & Hanley, J. R. (2004). Learning a transparent orthography at five years old: Reading development of children during their first year of formal reading instruction in Wales. *Journal of Research in Reading, 27*, 1–14.

Stanovich, K. E. (1992). Speculations on the causes and consequences of individual differences in early reading acquisition. In P. B. Gough, L. C. Ehri, & R. Treiman (Eds.), *reading acquisition* (pp. 307–342). Hillsdale: Lawrence Erlbaum.

Stuart, M. (1999). Getting ready for reading: Early phoneme awareness and phonics teaching improves reading and spelling in inner-city second language learners. *The British Journal of Educational Psychology, 69*, 587–605.

Torgesen, J. K. (2000). Individual differences in response to early interventions in reading: The lingering problem of treatment resisters. *Learning Disabilities Research and Practice, 15*, 55–64.

Torgesen, J. K., & Davis, C. (1996). Individual difference variables that predict response to training in phonological awareness. *Journal of Experimental Child Psychology, 63*, 1–21.

Torgesen, J. K., Alexander, A. W., Wagner, R. K., Rashotte, C. A., Voeller, K., & Conway, T. (2001). Intensive remedial instruction for children with severe reading disabilities: Immediate and long-term outcomes from two instructional approaches. *Journal of Learning Disabilities, 34*, 33–58.

Troia, G. A. (1999). Phonological awareness intervention research: A critical review of experimental methodology. *Reading Research Quarterly, 34*, 28–52.

Unsen, M. (2008). *Statistiques globales et analyse des résultats scolaires. Année 2007–2008 [Global statistics and analyse of school results. School year 2007–2008]*. Luxembourg: Ministère de l'Education nationale et de la Formation professionnelle.

Wagner, R. K., Torgesen, J. K., Laughon, P., Simmons, K., & Rashotte, C. A. (1993). Development of young readers' phonological processing abilities. *Journal of Educational Psychology, 85*, 83–103.

Weber, J.-J. (2009). *Multilingualism, education and change*. Frankfurt: Peter Lang.

Weber, J., Marx, P., & Schneider, W. (2007). Die Pravention von Lese-Rechtschreibschwierigkeiten bei Kindern mit nichtdeutscher Herkunftssprache durch ein Training der phonologischen Bewusstheit [Preventing reading and spelling difficulties in a population of immigrant children by a training of phonological awareness]. *Zeitschrift für Padagogische Psychologie, 21*, 65–75.

Wesseling, R., & Reitsma, P. (1998). Phonemically aware in a hop, skip, and a jump. In P. Reitsma & L. Verhoeven (Eds.), *Problems and Interventions in Literacy Development* (pp. 81–94). Dorbrecht: Kluwer Academic Publishers.

Wimmer, H. (1996). The early manifestation of developmental dyslexia: Evidence from German children. *Reading and Writing, 8*, 171–188.

Wimmer, H., & Goswami, U. (1994). The influence of orthographic consistency on reading development: Word recognition in English and German children. *Cognition, 51*, 91–103.

Wimmer, H., & Hummer, P. (1990). How German-speaking first graders read and spell: Doubts on the importance of the logographic stage. *Applied-Psycholinguistics, 11*, 349–368.

Wimmer, H., Hartl, M., & Moser, E. (1990). Passen "englische" Modelle des Schriftspracherwerbs auf "deutsche" Kinder? Zweifel an der Bedeutsamkeit der logographischen Strategie.[Do "English"reading models correspond to „German"children? Doubts on the importance of the logographic stage.]. *Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie, 22*, 136–154.

Wimmer, H., Landerl, K., & Frith, U. (1999). Learning to read German: Normal and impaired acquisition. In M. Harris & G. Hatano (Eds.), *Learning to read and write: a cross-linguistic perspective* (pp. 34–50). New York: Cambridge University Press.

Wimmer, H., Landerl, K., Linortner, R., & Hummer, P. (1991a). The relationship of phonemic awareness to reading acquisition: More consequence than precondition but still important. *Cognition, 40*, 219–249.

Wimmer, H., Zwicker, T., & Gugg, D. (1991b). Schwierigkeiten beim Lesen und Schreiben in den ersten Schuljahren: Befunde und Peristenz der Verursachung. [Problems in reading and writing during the early

years of school: Findings concerning the persistence and causes of these problems]. *Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie, 23*, 280–298.
Yeh, S. (2003). An evaluation of two approaches for teaching phonemic awareness to children in Head Start. *Early Childhood Research Quarterly, 18*, 513–529.

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Current themes of research:

Reading and writing acquisition. Emergent writing. Phonological awareness. Spelling strategies. Multicultural context. Education.

Most relevant publications in the field of Psychology of Education:

Bodé, S., Serres J., & Ugen, S. (2009). Similarities and differences of Luxembourgish and Romanophone 12 year olds' spelling strategies in German and in French. *Written Language & Literacy, 12,* 82–96.
Bodé, S. (2008). Profils de performances des enfants luxembourgeois en orthographe allemande et en orthographe française [Performance profiles of Luxembourgish children in German and French orthography]. In E. Loarer, J.-L. Mogenet, F. Cuisinier, H. Gottesdiener, P. Mallet, & P. Vrignaud (Eds.), *Perspectives différentielles en psychologie*. Rennes: Presses Universitaires de Rennes.
Bodé, S., & Serres, J. (2006, September). *Profils de performances atteints en orthographe allemande et française: les enfants à difficultés*. [Children at risk: Performance profiles in German and French orthography]. Paper presented at the 19e Colloque International de l'ADMEE- Europe, Luxembourg, Luxembourg.
Bodé, S., & Content, A. (2005, September). *Etude de l'effet différentiel d'un programme d'entraînement de la conscience phonologique en fonction du niveau initial de développement de la conscience phonologique* [Link between phonological awareness training effects and initial phonological awareness development]. Paper presented at the 16e Journées de Psychologie Différentielle,Luxembourg, Luxembourg.
Bodé, S., Beffort, A., Heinen, S., Jenn, P., Kinnen, M., Larosch, A., Lemmer, M., & Rasqué, N. (2004). *Phonologesch Bewosstheet am Spillschoulsalter* [Phonological awareness at kindergarten age]. Luxembourg: Université du Luxembourg.

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Current themes of research:

Reading acquisition. Visual word recognition. Dyslexia. Spoken word recognition. Numerical cognition.

Most relevant publications in the field of Psychology of Education:

Content, A. (1985). Le développement de l'habileté d'analyse phonétique de la parole. (The development of phonetic analysis ability). *Année Psychologique, 85,* 73–99.
Content, A., Kolinsky, R., Morais, J., & Bertelson, P. (1986). Phonetic segmentation in prereaders: Effect of corrective information. *Journal of Experimental Child Psychology, 42,* 49–72.
Leybaert, J., & Content, A. (1995). Reading and spelling acquisition in two different teaching methods: A test of the independence hypothesis. *Reading and Writing, 7,* 65–88.
Content, A., & Peereman, R. (2000). La reconnaissance des mots écrits. In J. A. Rondal & X. Seron (Eds.), Troubles du Langage. Liège: Mardaga, pp. 257–288.
Content, A., & Zesiger, P. (2000). L'acquisition du langage écrit. In J. A. Rondal & X. Seron (Eds.), Troubles du Langage. Liège: Mardaga, pp. 179–209.