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Phonological awareness and reading in Northern Sotho – Understanding the contribution of phonemes and syllables in Grade 3 reading attainment

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Background: The role of phonological awareness (PA) in successful reading attainment in Northern Sotho has received some attention. However, the importance of developing an awareness to the different phonological grain sizes that underlie decoding (i.e. to different dimensions of PA) has not been established in this language.

Aim: This study assessed different levels of PA in Northern Sotho learners in order to determine the relationship between phoneme awareness, syllable awareness and reading.

Setting: The research was conducted in Atteridgeville, a suburb in Tshwane. The participants were Grade 3 learners who spoke Northern Sotho as home language, and who received their literacy instruction in Northern Sotho in the foundation phase.

Method: The research was cross-sectional, with a correlational component. Phoneme awareness was assessed via a phoneme identification and elision task, whereas syllable awareness was assessed with a syllable elision task.

Results: Statistical analyses revealed that Northern Sotho learners are significantly better at identifying syllables than phonemes, but that phoneme awareness predicts reading outcomes more accurately.

Conclusion: This study suggests that phoneme awareness does not necessarily develop early or automatically in languages with a simple syllable structure and a transparent orthography and evaluates this finding against the predictions of the Psycholinguistic Grain Size Theory. The importance of explicitly teaching phoneme–grapheme correspondences to Northern Sotho learners is highlighted.

Introduction

Phonological awareness (PA) is broadly defined as a sensitivity to the sounds and sound structure of a particular language (Anthony et al. 2003). PA plays a key role in reading development across languages, regardless of the phonological structure, the orthography and the writing system of the language in which a child learns to read (Castles & Coltheart 2004; Diemer 2016; Goswami 2006; Makaure 2017; McBride-Chang et al. 2008; Newmans et al. 2010; Wagner et al. 1997; Wilsenach 2013; Ziegler & Goswami 2005). The reason for this is that PA facilitates an individual's ability to distinguish, analyse and manipulate the sound units that constitute words – an ability that is critically important when learning to read, as it allows beginning readers to associate sound units of varying 'grain sizes' (i.e. phonemes, onsets, rimes and syllables) with graphemes and ensures the formation of stable phoneme–grapheme correspondences (Goswami 2010). In other words, readers need PA skills in order to grasp the alphabetic principle (i.e. that letters on a page correspond to sounds in a language) (Liberman, Shankweiler & Liberman 1989). Poor PA skills lead to poor decoding skills, which in turn affect reading automaticity and fluency, ultimately causing poor comprehension skills.

The majority of South African learners perform significantly below international reading comprehension standards and fail to reach many normal literacy milestones at an appropriate age (Department of Basic Education 2015; Spaull 2013). This problem is particularly pronounced in rural schools, where most children learn to read in an African language (Gardiner 2017). In the 2011 prePIRLS (preProgress in International Reading Literacy Study), children learning to read in Northern Sotho (one of 11 official languages that are used as medium of instruction in South Africa) were as much as 3 years behind the norm in terms of reading ability (Spaull 2013). In the 2016 PIRLS study, 93% of South African learners learning to read in Northern Sotho failed

to reach the low benchmark, and Northern Sotho learners performed worse than any of the other African language learner groups (Howie et al. 2017). Very little systematic research has focused on the role of PA skills in acquiring reading skills in the African languages spoken in South Africa, and the contribution of underdeveloped PA to poor literacy outcomes is not fully understood. More specifically, the relative importance of developing sensitivity to different phonological grain sizes in Northern Sotho (when learning to read in this language) has never been investigated. The aim of this study is to fill this gap and to share evidence-based ideas about how reading should to be instructed in Northern Sotho.

Literature review

Phonological awareness in reading attainment

PA is a multicomponent skill (Alcock, Ngorosho & Jukes 2017), which is typically categorised into three dimensions, namely 'phoneme awareness', 'onset-rime awareness' and 'syllable awareness' (Castles & Coltheart 2004). Easier dimensions of PA, such as the ability to synthesise phonemes into syllables and to detect the number of syllables in a word (i.e. syllable awareness) facilitate and predict the first stages of reading acquisition (Perfetti et al. 1987). More complex levels of PA, such as the ability to segment words into their constituent sounds (i.e. phoneme awareness) and the ability to separate the initial consonant or consonant cluster in a word from the remaining vowel and consonant(s) (i.e. onset-rime awareness) are typically less developed in first graders who start to read. Phoneme awareness often only develops as a consequence of reading instruction (Castles & Coltheart 2004) and perhaps not at all in people who never received literacy instruction (Alcock et al. 2010).

Syllable awareness allows an individual to recognise, segment and blend the syllables within a word (Lane 2007). For example, the word *elephant* contains the three syllabic units /e/-/le/-/phant/. Apart from segmenting, children must learn how to blend separate syllabic units into words (e.g. /num/-/ber/ into *number*). Phoneme awareness allows a child to make connections between individual sounds and letters. For example, *hat* can be split into its phonemic components /h/-/a/-/t/, with the sounds /h/, /æ/ and /t/ corresponding to the letters 'h', 'a' 't'. Many studies have found that phoneme awareness, which relies heavily on analytical skills, does not reliably predict reading progress in the first grade; rather, phoneme awareness abilities are initially predicted by early progress in learning to read and only later on do they start to predict further success in reading (Perfetti 1994; Shankweiler & Fowler 2004). In English, children develop PA skills in a hierarchical manner, proceeding from whole words to syllables, to onset-rimes to phonemes (Goswami 2010). Convincing evidence for this hierarchical development is offered by longitudinal studies that carefully controlled for task complexity – this is important as performance in PA depends on the cognitive demands of the task being used to measure it. At the phoneme level, for example, identification is easier than segmentation, segmentation is easier than blending and blending is easier than deletion. Anthony et al. (2003) found that 'children mastered word-level skills before syllable-level skills, syllable-level skills before onset-rime level skills, and onset-rime-level skills before phoneme-level skills'. In another study, Anthony and Lonigan (2004) compared four longitudinal studies that explored the development of PA skills in young children (i.e. the studies of Lonigan et al. 1998; Muter, Hulme & Snowling 1997; Muter et al. 1997; Wagner et al. 1997). This systematic comparison showed that:

> within and across the four studies, younger children were sensitive to larger linguistic units but less so to smaller linguistic units, and older children were sensitive to both larger and smaller linguistic units. (Anthony & Lonigan 2004:52)

This age-related pattern was also observed in a number of other studies, including those of Anthony and Francis (2005), Treiman (1999) and Wagner et al. (1997). The different dimensions of PA are believed to be differentially related to reading acquisition, with phoneme awareness emerging regularly as the strongest predictor of reading ability (McBride-Chang et al. 2008; Newmans et al. 2010).

Children's PA is shaped by the phonological structure (particularly the syllable structure) and the orthographic transparency of the language in which they learn to read. PA skills develop faster in children who speak languages with simple syllable structures, such as Italian, Spanish, Finnish, Turkish, Japanese and Chinese, than in children speaking languages with complex syllable structures, such as English, German, Dutch and French (Alcock et al. 2010; Goswami 2010). Syllables are 'simple' when they are C(consonant) V(owel) units, and 'complex' when they contain a number of C and V units (Goswami 2010). In languages with a simple syllable structure, the predominant syllable type is CV, and onset-rime segmentation of a syllable is usually equivalent to phonemic segmentation. For instance, an Italian child segmenting a word like *vero* at the onset-rime level, will also arrive at the constituent phonemes (/v/-/e/-/r/-/o/) of this word. In languages with complex syllable structures, various combinations of C and V units are possible. In English, for example, 'single syllables can be V(*a*), CV (*go*), CVC (*cat*), CCVC (*pram*), CVCC (*hold*), CCVCC (*stamp*), CCCVC (*spread*) and CCCVCC (*sprained*)' (Goswami 2010:27). In such languages, onset-rime segmentation is typically not equivalent to phoneme segmentation. The words *spoon*, *jump* and *crust* (linguistic examples from Goswami 2010) contain clusters of phonemes in both the onsets and rimes. In order to reach the phoneme level in these words, an extra cognitive step is necessary. A priori, it should thus be easier to become phonologically aware of phonemes in a simple syllable (i.e. CV) than in a complex syllable (e.g. CCVCC), and an awareness of phonemes is thought to develop more rapidly in children who are segmenting simple syllables with a CV structure than in children who have to analyse complex syllables. The language-specific influences of phonological structure and orthography on PA and reading development have been explained by the Psycholinguistic Grain Size

Theory (PGST) (Goswami 2006, 2010; Goswami, Ziegler & Richardson 2005), which will be discussed in the next section.

Psycholinguistic Grain Size Theory

Central to the PGST is the notion of 'phonological recoding', which involves the mapping of orthographic symbols onto phonological units. According to the PGST, children have to deal with three potential problems when learning to read, namely availability, consistency and granularity of grapheme-to-phoneme mappings (Ziegler & Goswami 2005). The availability problem entails that not all phonological units are equally accessible to a child prior to reading. Syllables (an early-developing grain size) are more accessible than phonemes, and thus a Japanese child, who learns to read via a system where visual symbols correspond to syllables will have an advantage over an English child, who has to learn that phonemes (a later-developing grain size) are represented by letters. Phonemes, in particular, may be inaccessible at first, and as reading is acquired, the developmental rate of phoneme awareness differs across languages, with faster acquisition in more consistent orthographies (Goswami 2010). The consistency problem reflects linguistic differences in orthographic transparency. In languages like Finnish, Greek, Spanish and Italian, mapping between letters and sounds is transparent in that it happens in a one-to-one manner (letters correspond consistently to one phoneme). In other languages, including English, Danish, Dutch and French, mappings between letters and sounds are more opaque. Here, letters or letter clusters can be pronounced in more than one way (e.g. the /o/ in *do* and *so* or the /ea/ in *clean* and *break* (Ziegler, Stone & Jacobs 1997) and a single phonological unit can be represented by multiple orthographic units (e.g. /k/ is represented with either 'c' (*cat*), 'k' (*kit*) or 'ck' (*pack*) (Treiman 1999). The granularity problem considers the 'absolute number of mappings that need to be learned' (Goswami 2010:36). According to Goswami, when large grain sizes (i.e. words, rimes and syllables) are more accessible in a phonological system than smaller grain sizes (i.e. onsets and phonemes), children have many more orthographic units to learn; the reason being that there are more syllables than rimes, more rimes than graphemes and more graphemes than letters in any particular system. Proponents of the PGST have argued that reading ability in any language will reflect the efficiency with which the problems of availability, consistency and granularity have been solved (Ziegler & Goswami 2005).

The phonological grain size used by the children in reading thus essentially depends on phonological structure, as well as on the consistency with which that phonology is represented in the orthography. In languages with shallow orthographies (showing consistent phoneme–grapheme correspondences), children can rely heavily on small grain sizes (i.e. phonemes) during recoding (Ziegler & Goswami 2006). In opaque or deep orthographies (with inconsistent phoneme–grapheme correspondences), readers are forced to use multiple grain sizes during recoding, because of the inconsistency of phoneme–grapheme correspondences. Children who learn to read in English, for example, have to develop multiple reading strategies. This includes whole-word recognition of 'exceptions words', such as *once, put* and *does*, where letter-sound irregularities mean that sounding out of words will not work. Many of these words must more or less be memorised (Murray n.d.). Children will also use rhyme analogy strategies (to read words like *light*, *night* and *fight*), and grapheme–phoneme recoding strategies (to read regular words like *tip*, *fat* and *dog*) (examples from Goswami 2010:36). There is much debate about *how* and *when* irregular words should be introduced and which reading strategies learners should be taught to decode them. Many reading practitioners believe that this depends on the actual phonics patterns that learners have been taught (Bradfield 2017; Farrell, Osenga & Hunter 2013). In English, learners will manage to decode the words *when*, *pick* and *much* only if they have been taught digraphs and have started to read words with digraphs. While orthographies are never really completely opaque or completely shallow (rather, languages fall on a continuum), one can assume that learning to read in English (which falls on the less-consistent side of the continuum) may be more difficult than learning to read in a language with a more consistent orthography (Ziegler & Goswami 2005). While many phonological development models assume that young readers have to develop sensitivity to larger units before smaller units can be developed (Anthony et al. 2003; Anthony & Francis 2005), the PGST assumes that sensitivity to smaller grain sizes (like phonemes) can in fact develop early on, depending on the phonological complexity of the language and the consistency of the orthography (Ziegler & Goswami 2005).

Phonological awareness and reading in African languages

The African languages spoken in South Africa generally have a simple syllabic structure and a transparent orthography. Recently, some studies focused on the relationship between phonological skills and literacy development in these languages. Diemer (2016) assessed the relationship between PA (including syllable awareness and phoneme awareness) and various aspects of literacy development (including reading fluency, accuracy, comprehension and spelling) in Grade 3 learners learning to read in Xhosa. She found that children were more sensitive to syllables than to phonemes; in fact, many learners had not developed a sensitivity to phonemes by Grade 3, a surprising finding given the simple syllable structure and relatively transparent orthography of Xhosa. She further reported that phoneme identification and segmentation reliably predicted spelling, but that syllable deletion was the strongest predictor of reading accuracy. Malda, Nel and Van de Vijver (2014) examined the relationship between PA (operationalised as phoneme blending, phoneme segmentation and phoneme deletion) and reading in Grade 3 Setswana learners and found significant relations between PA and word and text reading ability. Wilsenach (2013) assessed PA (assessed with a syllable awareness task) and reading skills in Northern Sotho-speaking third graders, who received their schooling from Grade 1 to 3 in either Northern

Sotho or English. She found a significant association between syllable awareness and reading in Northern Sotho in both groups, but the study was limited because of the small sample size and by the fact that phoneme awareness was not assessed. Makaure (2017) assessed PA (among other phonological processing skills) in Grade 3 Northern Sotho learners, using a phoneme isolation task and an elision task. Phoneme isolation was found to be a poor predictor of reading achievement, while elision (a composite score on phoneme deletion and syllable deletion) was a strong and consistent predictor of reading. This study was limited too, in that phoneme elision and syllable elision were not analysed separately, and thus no firm conclusions could be reached regarding sensitivity to various phonological grain sizes in Northern Sotho.

While evidence exists that PA skills are important for becoming literate in African languages and that learners are sensitive to larger grain sizes, there have been no systematic investigation into the role of various phonological grain sizes in reading development in Northern Sotho. Northern Sotho shares the characteristic agglutination of other Bantu languages and many of the typical grammatical features of this group of languages. The following linguistic features of Northern Sotho are relevant for this study:

- There is a one-to-one correspondence between phonemes and graphemes in Northern Sotho, that is, it has a transparent orthography.
- The duration of syllables in Northern Sotho words are roughly equal, and thus it is described as a syllable-timed language. Syllables generally lack reduced vowels. Each syllable receives approximately equal stress, but stressed syllables do exist. Zerbian (2006) notes that penultimate syllables of words are sometimes lengthened, as in /dume: la/ and /dumela: ŋ/. However, syllable stressing does not *typically* occur at the penultimate syllable of words, and it is not considered to be prominent.
- The phonological structure is simple; containing mostly open syllables, few consonants clusters and few one-syllabic words. Northern Sotho has the same syllable structure as other African languages in the Sotho group, namely a CVCV (or CVCVCV) or VCV structure (Demuth 2007).

There are other characteristics of Northern Sotho that are interesting in understanding reading development. For example, the agglutinating nature of the language provides interesting opportunities to investigate how the spelling system maps onto different levels of linguistic representation, notably morphology (which is profuse in agglutinating languages). Also, Northern Sotho would be an ideal language to investigate the relationship between morphological richness and word identification. However, these aspects are beyond the scope of the current study, where the aim is only to determine the nature of PA in Northern Sotho Grade 3 children and to determine the relationship between various levels of PA and reading in the tested sample. The study was guided by two research questions, namely (1) Are Northern Sotho children who acquired reading in their first language equally sensitive to different phonological grain sizes (i.e. syllables and phonemes)? and (2) What is the nature of the interrelationship between phoneme awareness, syllable awareness, word reading and fluent reading in Northern Sotho children? Given the simple phonological structure of Northern Sotho and its transparent orthography, it is hypothesised that the learners will be sensitive to phonemes by Grade 3. Furthermore, it is anticipated that Northern Sotho children can rely on a phoneme–grapheme recoding strategy to ensure effective recoding of symbols to sounds. As such, it is expected that phoneme awareness will be a more robust predictor of reading ability than syllable awareness. Finally, because PA typically loses its predictive value for reading ability after the first two grades (especially in languages with transparent orthographies), it is anticipated that PA's contribution to Northern Sotho reading might be small in this sample.

Research methodology

Participants and research setting

The current study was conducted in a primary school situated in a low socio-economic status (SES) suburb of Tshwane (one of the capital cities of South Africa). Northern Sotho is used as language of learning and teaching (LoLT) from Grade 1 to 3 in this school. English becomes the LoLT from Grade 4 onwards. The school was classified as a 'quintile one' school and had a feeding scheme at the time of the study.[1] All the participants spoke Northern Sotho as home language and were introduced to English as an additional language in Grade 1.[2] The school had a functioning library, containing around 5000 books (including graded readers) in both Northern Sotho and English. However, the school librarian indicated that none of the foundation phase classes (Grade 1 to Grade 3) systematically visited the library during teaching hours, the reason being that it was already a challenge to fit the curriculum into the available teaching hours in this particular setting. Learners' only opportunity to visit the school library was thus during break time. The closest community library is 2.4 km from the school. While opportunities to be exposed to a range of printed materials thus exist, parents in low SES communities are less likely to stimulate book-reading activities, and the assumption is that the participants in this study have few opportunities to engage with print outside the classroom. Using a purposive and convenience sampling technique, 60 Grade 3 learners were selected randomly (from those who returned their parental consent forms) and assessed on a range of phonological processing and reading skills. The average age of the learners was 8 years and 7 months. The sample included 29 girls and 31 boys.

1.South African public schools are classified into five groups (quintiles). The purpose of this classification, which is determined by socio-economic indices in the surrounding community, is to determine the allocation of financial resources to schools. Schools classified as quintile one schools are the 'poorest' schools, while quintile five schools are the 'least poor'.

2.The term 'home language speaker' is used in South Africa to refer to speakers who have first-language competency in a language.

Research design, research materials and data processing

The study utilised a cross-sectional quantitative research design. The participants were tested one by one in a quiet room in the school library. All data were collected during the third term of the school year. No standardised tests exist to assess PA skills or reading in Northern Sotho, and thus all tests were custom-made to meet the aims of the study. The PA tasks were similar (in design) to the isolation and elision tasks in the *Comprehensive test of phonological processing* (CTOPP) (Wagner et al. 2013).[3] Pearson correlations between the Northern Sotho PA measure and the corresponding English CTOPP measures were significant and strong ($r = 0.62$ for the Northern Sotho and English elision tasks; and $r = 0.63$ for the Northern Sotho and English isolation tasks), suggesting that the Northern Sotho PA measures tapped into the same underlying skills than the English PA measures of the CTOPP. Word reading was assessed with a custom-made word list, while fluent reading was assessed using a grade-appropriate reader.

Phoneme awareness was measured with a *phoneme isolation* and *phoneme elision* task. Phoneme isolation tests an individual's ability to identify target sounds within words (Wagner et al. 2013). The task consisted of 16 items (one practice and 15 test items). The first five items consisted of three-sound words, and learners had to identify the first, middle or last sound. For example, the researcher would ask a participant to identify the first sound in the word *ela*. The remainder of the test items contained more than three sounds and the learner had to identify the second, third or fourth sound. For instance, the learner would be asked to identify the last sound in the word *pedi*. The majority of the test items ($n = 14$) were two-syllable words, the final test item was three syllables long. Individual raw scores (out of 15) were transformed to percentages, which were used to calculate a mean percentage.

Phoneme elision tasks measure an individual's ability to produce a word after being instructed to leave out a selected sound from the word (Wagner et al. 2013). In the phoneme elision task, learners were required to say a word and then had to repeat the word after deleting a target phoneme. The target phoneme was at the beginning (Say *bana;* Now say *bana* without saying /b/), middle (Say *taolo;* Now say *taolo* without saying /a/) or end (Say b*ofe;* Now say *bofe* again without saying /e/) of the word, leading to three conditions (initial elision, middle elision and final elision). The phoneme elision task consisted of nine items (three per condition). Phoneme elision in the beginning and end condition was assessed using two-syllable words; and learners always had to delete a consonant from the beginning of an item and a vowel from the end of an item. Phoneme elision in the middle condition was assessed with three-syllable words, and learners had to delete a vowel.

3.The English Phonological awareness (PA) skills of the participants were also assessed, using the *Comprehensive test of phonological processing*. The Northern Sotho tasks were thus designed with the idea to compare PA skills across Northern Sotho and English in the learners, as much as possible. However, given the aim of this article, only Northern Sotho data are reported.

Syllable awareness was assessed with a syllable elision task, in which learners had to say a word, and then had to repeat the word after dropping a target syllable from the beginning, middle or end of the word. To illustrate, participants were prompted to repeat a word after deleting the beginning syllable (Say *bolelo*; Now say *bolelo* without saying /bo/); the middle syllable (Say *garafo*; Now say garafo without saying /ra/) or the end syllable (Say *batswadi*; Now say *batswadi* without saying /di/). The syllable elision task consisted of nine items; that is, three test items for each of the conditions. All test items were three syllables long. The two elision tasks were preceded with a single practice session, in which learners practiced to delete both the first and the last syllable of a two-syllable word. The syllable elision task always preceded the phoneme elision task, as it became clear during pilot sessions that learners found the manipulation of syllables easier. For both elision tasks, individual raw scores (out of nine) were transformed to percentages, which were used to calculated mean percentages for phoneme elision and syllable elision. In subsequent data processing, mean percentages were also calculated for each of the positions (beginning, middle and end) in the phoneme and syllable elision tasks.

Word reading was tested using a reading card containing 30 items, which progressed from simple words like *nna*, *ema* and *bona* to longer and more complex words like *phaphamala*, *tshisepere* and *gwadigwatša*. Individual raw scores out of 30 were converted to percentages and used to calculate a mean percentage. Fluent reading was assessed with a 1-min test. Learners were asked to read aloud from a Northern Sotho graded reader, *Ngwana yo moswa* (Brain 2007), for 1 min. The chosen reader is described as a Level 1 reader by New Reader publishers and was deemed to be well within the cognitive reading ability of the children. A raw score for fluent reading was calculated by counting the total number of words read and then subtracting the number of incorrectly read words. The number of correctly read words was used as a measure of fluent reading.

In order to assess the internal consistency of the Northern Sotho PA tasks, Cronbach's alpha statistics were calculated for the phoneme isolation items, for the phoneme and syllable elision items combined and for the word reading items. The internal reliability of the phoneme isolation items and the combined elision items were acceptable (15 items; $\alpha = 0.74$ and 18 items; $\alpha = 0.77$). The reading task was found to be very reliable (30 items; $\alpha = 0.82$).

Ethical considerations

Participation was voluntary, and learners were only tested if their parents signed an informed consent form, which was provided in both Northern Sotho and English. The informed consent form was purposefully written in simple terms (in both languages) to give parents the best possible opportunity to understand the content. Even so, the fact that parents signed the consent form cannot be taken as an

indication that they are functionally literate. Ethical clearance for the project was obtained from the University of South Africa and the Gauteng department of Basic Education. Learners' anonymity was assured at all times, and data were not revealed to any third party. It was explained to learners that they could withdraw from the test session at any point, and learners were awarded with stickers and sweets after being tested.

Results

The data were analysed using IBM SPSS software, version 20 (IBM 2016). The means, standard deviations and normality scores of all the measures (based on the raw scores) are presented in Table 1.

As shown in Table 1, Shapiro–Wilk tests revealed that the data were not normally distributed. Removing outliers did not improve the normal distribution. For this reason, non-parametric statistical tests (a series of related samples Wilcoxon signed-rank tests) were used to determine whether the overall scores obtained on the various phonological measures were significantly different from each other. The sign tests indicated that the null hypothesis (that the median of differences between the relevant variables equals 0) should be rejected in all cases. The median difference between *phoneme isolation* (*Mdn* = 63.33) and *phoneme elision* (*Mdn* = 44.44) was significant (z = -4.52; p = 0.000), as was the median differences between *phoneme isolation* and *syllable elision* (*Mdn* = 66.67), z = -2.81; p = 0.005. *Phoneme elision* and *syllable elision* also differed significantly (z = -4.94; p = 0.000). Subsequent analyses of the elision data indicated that the mean differences between the phoneme elision and syllable elision scores (depending on the position of the unit that had to be deleted) were also significant. Sign tests indicated that in the phoneme elision task, *phoneme elision beginning* (*Mdn* = 0) was significantly different from *phoneme elision middle* (*Mdn* = 33.33), z = -2.70; p = 0.007, and from *phoneme elision end* (*Mdn* = 83.33), z = -5.19; p = 0.000. Likewise, *phoneme elision middle* and *phoneme elision end* differed significantly (z = -4.78, p = 0.000) from each other. For the syllable elision task, sign tests indicated that *syllable elision beginning* (*Mdn* = 100) was significantly different from *syllable elision middle* (*Mdn* = 33.33), z = -5.28; p = 0.000, and from *syllable elision end* (*Mdn* = 66.67), z = -2.83; p = 0.005. Finally, *syllable elision middle* differed significantly from *syllable elision end* (z = -3.04, p = 0.002).

TABLE 1: Mean percentages (for phonological awareness measures and word reading), mean raw score (for fluent reading), standard deviations and normality statistics.

Measures	Mean (N = 60)	SD	Shapiro–Wilk		
			Statistic	*df*	Sig.
Phonological awareness (overall)					
Phoneme isolation	56.88	25.22	0.955	60	0.027
Phoneme elision	43.15	26.91	0.936	60	0.003
Syllable elision	65	26.34	0.928	60	0.002
Elision scores per position					
Phoneme elision beginning	26.11	31.94	0.771	60	0.000
Phoneme elision middle	40	33.50	0.839	60	0.000
Phoneme elision end	63.89	40.38	0.765	60	0.000
Syllable elision beginning	80.55	30.25	0.661	60	0.000
Syllable elision middle	47.22	37.47	0.854	60	0.000
Syllable elision end	66.66	35.25	0.810	60	0.000
Northern Sotho reading					
Word reading percentage	67.11	31.91	0.781	60	0.000
Fluent reading raw score	29.05	21.62	0.937	60	0.004

SD, standard deviation; *df*, degree of freedom; Sig., significance.

Thus, the participants performed significantly better in the syllable elision task than in the phoneme isolation and phoneme elision tasks. Furthermore, the position of the unit that had to be deleted had an effect on the learner's performance in the elision tasks. In the phoneme elision task, learners fared significantly worse when asked to delete units from the beginning of a word (compared to when asked to delete units from the middle or end). In the syllable elision task, learners performed significantly better when asked to delete syllables from the beginning of a word (compared to when asked to delete units from the middle or the end of a word).

Correlations and regressions

Spearman rho tests were used to test the interrelationships between phoneme isolation, phoneme elision, syllable elision, word reading and fluent reading. The overall scores obtained on the various PA measures were used in the analysis. Table 2 contains the r values of the correlational tests.

As can be seen in Table 2, *phoneme isolation* correlated moderately with both reading measures. *Phoneme elision* showed a strong correlation with both reading measures, while *syllable elision* showed a moderate correlation with both reading measures. Regarding the interrelationship between the PA measures, it was found that all the measures were moderately to strongly associated with each other. *Word reading* and *fluent reading* were strongly correlated.

Despite the non-normal distribution of the data, multiple regression analyses were run to inform the correlational component of the analysis. Multiple regressions are quite robust against violations of normality in 'large enough sample sizes (i.e. > 40)' (Ghasemi & Zahediasl 2012:486) and no non-parametric alternative test exists in SPSS. Furthermore, although the Spearman rho tests revealed significant correlations between several of the predictor variables, none of these correlations were above 0.80, and

TABLE 2: Spearman rho correlations between phonological awareness and reading measures.

PA and reading measures	1	2	3	4	5
1. Phoneme isolation	-	0.58*	0.60*	0.57*	0.55*
2. Phoneme elision	0.58*	-	0.66*	0.70*	0.61*
3. Syllable elision	0.60*	0.66*		0.59*	0.60*
4. Word reading	0.57*	0.70*	0.59*	-	0.89*
5. Fluent reading	0.55*	0.61*	0.61*	0.89*	-

PA, phonological awareness.

*, Correlation significant at the 0.01 level (2-tailed).

hence, multicollinearity was not deemed a serious problem (Field 2013). A multiple regression model (see Table 3) with *word reading* as dependent variable and *phoneme isolation*, *phoneme elision* and *syllable elision* as predictor variables (phoneme isolation and phoneme elision were entered at step 1; syllable elision was entered at step 2) showed that phoneme elision was the only significant predictor of word reading. Phoneme isolation and syllable elision made no significant contribution to word reading. A multiple regression model (see Table 4) with *fluent reading* as dependent variable and *phoneme isolation*, *phoneme elision*, *syllable elision* and *word reading* as predictor variables (phoneme isolation and phoneme elision were entered at step 1, syllable elision was entered at step 2 and word reading was entered at step 3) showed that phoneme isolation and phoneme elision significantly predicted fluent reading at the first step of the model. After syllable elision was added in step 2, only phoneme elision significantly predicted fluent reading. In step 3, when word reading was added as a predictor, the PA measures no longer predicted fluent reading. Thus, word reading was the only significant predictor of fluent reading in the final step of the analysis. The constant values, betas, standard errors, standardised betas and R^2 values for these regression analyses are given in Tables 3 and 4.

TABLE 3: Summary of multiple regression with *word reading* as dependent variable and *phoneme isolation*, *phoneme elision* and *syllable elision* as predictors.

Step	Predictors	Word reading			
		B	SE	*Beta*	*p*
Step 1	(Constant)	19.82	9.54	-	0.042
	Phoneme isolation	0.34	0.19	0.23	0.070
	Phoneme elision	0.65	0.17	0.47	0.000
Step 2	(Constant)	10.72	10.60	-	0.316
	Phoneme isolation	0.20	0.19	0.13	0.329
	Phoneme elision	0.51	0.19	0.37	0.008
	Syllable elision	0.36	0.19	0.25	0.074

B, individual contribution of each predictor to the model; SE, standard error; *Beta,* the number of standard deviations that the outcomes will change as a result of one standard deviation change in the predictor.

Note: $R^2 = 0.396$ for Step 1; ΔR^2 for Step 2 = 0.034.

TABLE 4: Summary of multiple regression with *fluent reading* as dependent variable and *phoneme isolation*, *phoneme elision, syllable elision* and *word reading* as predictors.

Step	Predictors	Fluent reading			
		B	SE	*Beta*	*p*
Step 1	(Constant)	-0.18	5.9	-	0.975
	Phoneme isolation	0.25	0.12	0.27	0.036
	Phoneme elision	0.35	0.11	0.42	0.002
Step 2	(Constant)	-6.32	6.52		0.336
	Phoneme isolation	0.15	0.12	0.16	0.232
	Phoneme elision	0.26	0.11	0.31	0.026
	Syllable elision	0.24	0.12	0.28	0.051
Step 3	(Constant)	10.69	4.97	-	0.036
	Phoneme isolation	0.07	0.09	0.08	0.468
	Phoneme elision	0.05	0.09	0.06	0.563
	Syllable elision	0.10	0.09	0.11	0.312
	Word reading	0.41	0.06	0.67	0.000

B, individual contribution of each predictor to the model; SE, standard error; *Beta,* the number of standard deviations that the outcomes will change as a result of one standard deviation change in the predictor.

Note: $R^2 = 0.381$ for Step 1; ΔR^2 for Step 2 = 0.041; ΔR^2 for Step 3 = 0.253.

Discussion

Over the past two decades, it has been established that literacy levels in South Africa are below that of other middle-income countries, despite the fact that the government has been allocating a significant amount of its GDP to education (around 15% in 2015–2016, which is proportionally higher than the education budget of countries like the United States, the United Kingdom and Germany) (Cohen 2017). Traditionally, studies about literacy in South Africa have focused on socio-economic issues related to language policy and language attitudes in education (e.g. Commeyras & Inyega 2007; De Klerk 2002; Hunt 2007; Plüddemann 2002). These studies typically mention the difficulties associated with learning in a second language, given that children speaking African languages have to switch to English as medium of instruction in Grade 4 in South Africa. However, very few studies have investigated South Africa's literacy crises from an angle that foregrounds the importance of PA and other cognitive–linguistic skills in learning to read, and no study has systematically investigated learners' sensitivity to various phonological grain sizes in Northern Sotho. The aim of this study was to fill this gap.

Two questions were posed at the outset, namely (1) Are Northern Sotho children who acquired reading in their first language equally sensitive to different phonological grain sizes (i.e. syllables and phonemes)? and (2) What is the nature of the interrelationship between phoneme awareness, syllable awareness, word reading and fluent reading in Northern Sotho children? Regarding the first question, the data suggest that Northern Sotho children are significantly more sensitive to syllables than to phonemes, even after almost 3 years of formal reading instruction in Northern Sotho. Overall, it was clear that PA was still developing in this sample, as evidenced by the fact that no ceiling effects were found. The third graders assessed here were significantly better at identifying and deleting target syllables from words than target phonemes and also fared significantly better in syllable elision than in a basic phoneme identification task. Overall, the data support previous research suggesting that PA skills develop in a hierarchical manner, proceeding from larger phonological grains to smaller grains (Goswami 2010). However, Northern Sotho has a simple syllable structure and a transparent orthography, and thus, given the assumptions of the PGST, the expectation was that children who already gained some experience as Northern Sotho readers would not find it challenging to identify and manipulate smaller grain sizes (i.e. phonemes). This expectation was not met, as phoneme awareness did not develop to the same level as syllable awareness after the onset of reading instruction. Thus, contrary to the propositions of the PGST, an awareness of smaller grain sizes does not necessarily develop automatically or early in children who speak a language with a simple CV structure and who learn to read in a language with a transparent orthography. This finding replicates Diemer's (2016) results,

who also reports poor phoneme awareness in Grade 3 Xhosa learners. In the absence of longitudinal developmental data on PA in African languages, one can only cautiously conclude that learners seem to reach relatively low levels of phoneme awareness. A tentative conclusion along these lines could be explained by teaching practices in South Africa, where correspondences between letters and sounds are taught through syllables (e.g. /b/ is taught via rote learning of *ba*, *be*, *bi*, *bo*, *bu*) (De Vos, Van der Merwe & Van der Mescht 2014). Because children are not actively taught to use a phoneme–grapheme recoding strategy, it takes them longer to develop phoneme awareness, and this could be a major factor in explaining poor decoding, and ultimately, poor reading fluency and the poor reading comprehension levels that are currently seen in too many South African learners. Malda et al. (2014:42) reached the same conclusion, stating that reading skills in their Grade 3 Setswana sample 'were apparently not yet developed to the extent that PA was of strongly reduced importance' and that 'reading instruction is not following an appropriate phonics approach, which may delay the point where decoding skills are no longer sources of individual differences'.

A more detailed analysis of the elision task revealed that learners were particularly insensitive to the phonemes that constitute the first syllable of a word. Deletion of the initial phoneme should be a very easy task in a transparent orthography such as Northern Sotho. Yet, only 26.11% of the responses to instructions such as '*say bana … now say bana again but don't say b*' were accurate. Typically, learners would answer this instruction by repeating the unit *na*, instead of *ana*. Learners appeared insensitive to the fact that the first syllable in a word can be segmented into smaller units, and processed the onset of words at the syllable grain. In contrast, syllable elision was most accurate when the word-initial syllable had to be deleted. Performance on the syllable elision and phoneme elision tasks were more similar in conditions where learners had to delete units from the middle or the end of a word. In both the syllable elision and phoneme elision tasks, learners found it significantly more difficult to delete units from the middle of the word than from the end of a word. This suggests that, even though syllables receive approximately equal stress in Northern Sotho, word-final units might be more sonorant to learners than word-medial units, a pattern that could be explained as a working memory constraint. Units at the beginning of a word are typically recalled with the greatest accuracy (a primacy effect), while recall accuracy for units following the first position is normally lower. Word-final units are typically recalled better than word-medial units (a recency effect), but not as accurately as word-initial units (Hurlstone, Hitch & Baddeley 2014). Diemer (2016) reported a similar working memory serial order effect in a syllable deletion task performed by Xhosa children who have not reached high levels of phoneme awareness.

With regards to the second question, it was found that phoneme elision strongly correlated with both word and fluent reading, whereas syllable elision and phoneme isolation moderately correlated with both reading measures. As can be expected, all the PA measures were moderately to strongly associated with each other; the strongest association was found between syllable elision and phoneme elision ($r = 0.66$, $p < 0.01$), possibly reflecting the similar cognitive processing demands of these tasks. A multiple regression analysis showed that phoneme elision was the only significant predictor of word reading, explaining 39.6% of the variance. Phoneme isolation and syllable awareness did not reliably predict word reading. Concerning fluent reading, word reading emerged as the strongest predictor of fluent reading. While phoneme elision was a good predictor of fluent reading (explaining 42.2% of the variance in the outcome of fluent reading at the second stage of the regression model), it lost its predictive value after word reading was included as a predictor, as was anticipated for a Grade 3 sample. Importantly, phoneme elision correlated strongly with word reading ($r = 0.70$; $p < 0.001$) and significantly predicted its outcome, suggesting that successful decoding is related to an ability to identify and manipulate phonological grain sizes at the phoneme level. Importantly, no claims about causality can be made because of the correlational nature of the research design – there probably is a reciprocal relationship between phoneme awareness and word reading, rather than a simple causal relation. An effective phoneme–grapheme recoding strategy is likely to result in word decoding, but learning to read will increase learners' awareness of sounds, as noted by several scholars (Perfetti 1994; Perfetti et al. 1987; Shankweiler & Fowler 2004). However, crucially, Shankweiler and Fowler (2004:492) concluded that 'the subsequent influence of literacy experience does not mitigate the importance of teaching phoneme awareness to kindergartners'. The correlation and regression statistics presented here suggest that it is important for Northern Sotho learners to develop sensitivity to smaller grain sizes, even when syllable awareness develops more intuitively, and that phoneme awareness needs to be taught explicitly to learners. Learners showed an enhanced awareness of syllables, but syllable awareness did not predict word or fluent reading. In line with previous research, phoneme awareness emerged as a more reliable predictor of reading success than syllable awareness, begging a re-evaluation of current reading instruction practices in the South African context. It could be that a systematic synthetic phonics approach would be better suited to the needs of South African learners than an analytic phonics approach. According to Logan and Johnston (2010) the:

> main principle behind synthetic phonics is that letter-sound correspondences and blending skills are taught early on and at a relatively fast pace so that children quickly have a method to read independently. (p. 176)

In a systematic synthetic phonics method, decoding is taught via a rule-based phonological approach (rather than focusing on whole-word recognition, guessing words using the context or predicting words based on grammatical knowledge) and given the evidence here, it seems possible that a single phoneme–grapheme recoding strategy will

boost the development of successful reading strategies in Northern Sotho.

This study is not without its limitations. The sample was not selected randomly, and thus, the results cannot be generalised. It was also not possible to assess other aspects of PA, such as segmentation and blending, the reason being that the participants were also tested on related phonological processing skills, such as phonological working memory and rapid automatised naming, in both Northern Sotho and in English. Because of time constraints, only a subset of PA skills could be included. Finally, the study utilised a cross-sectional design which precludes definite conclusions about the causal role of PA in acquiring fluent reading skills in Northern Sotho. Future research on the relationship between PA skills and reading in Northern Sotho should include a wider range of PA skills, should ideally test the development of these skills in a longitudinal manner and should ideally consider the influence of English (which is taught as an additional language from Grade 1) on the development of PA and reading skills in Northern Sotho.

Conclusion

This study investigated Northern Sotho learners' sensitivity to various phonological grain sizes and assessed the relative importance of various levels of PA in reading development in Northern Sotho. The results indicate that Northern Sotho children in Grade 3 have better syllable awareness than phoneme awareness, which could be explained by the phonological structure of Northern Sotho. Phoneme awareness was not particularly well developed in the tested sample, despite the fact that Northern Sotho has a transparent orthography, which theoretically, should boost the phoneme–grapheme mapping process. This could be related to teaching practice, where phonemes are not focused on. Importantly, syllable awareness failed to significantly predict reading in this sample. In contrast, phoneme elision significantly predicted both word reading and fluent reading, while phoneme isolation predicted fluent reading (but not consistently). In summary, phoneme awareness seems to be a better predictor of reading skills than syllable awareness in Northern Sotho and does not develop automatically after the onset of reading instruction. Therefore, the recommendation is that phoneme awareness should be explicitly taught using a systematic phonics approach in Northern Sotho, as sensitivity to phonemes will enhance children's ability to effectively recode symbols to sounds. It would also be worthwhile to explore other aspects of PA, such as segmentation and blending, in a longitudinal study. This will provide a clearer picture of how different PA skills contribute to various stages of reading development in Northern Sotho children.

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Competing interests

The author declares that she has no financial or personal relationships that may have inappropriately influenced her in writing this article.

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